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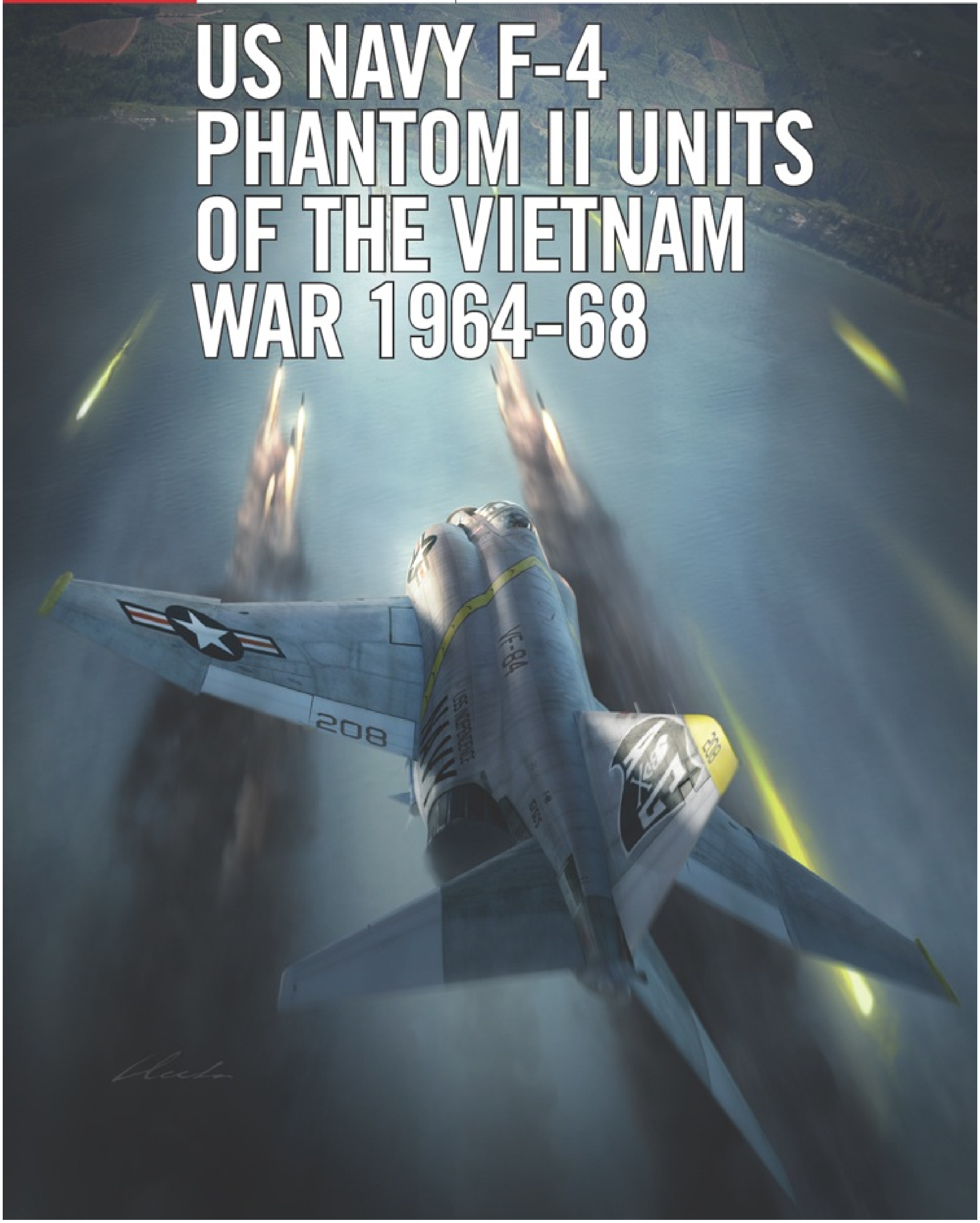
Peter E Davies

US NAVY F-4 PHANTOM II UNITS OF THE VIETNAM WAR 1964-68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US NAVY F-4 PHANTOM II UNITS OF THE VIETNAM WAR 1964-68

OSPREY
PUBLISHING

This book is dedicated to the memory of Capt John Nash, US Navy

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CHAPTER ONE

THUNDER CLOUDS

As hostilities in Southeast Asia intensified in mid-1964, McDonnell's F-4B Phantom II was already well established as the US Navy's all-weather, missile-armed interceptor. Within the Pacific Fleet, five squadrons – VF-21, VF-92, VF-96, VF-114 and VF-143 – were in business with F-4Bs by 1963, joined by VF-142, VF-151, VF-154 and VF-161 by December 1965. Nine Atlantic Fleet squadrons were also operating Phantom IIs by that time, and several of them would eventually be involved in the Vietnam War too. Most of these units had converted from McDonnell F3H Demon or Douglas F4D Skyray fighters, but from 1964 several F-8 Crusader squadrons, including VF-32, VF-33, VF-84 and VF-154, began to transition to the two-seat Phantom II. However, in July 1964 F-8s still outnumbered F-4s in the Pacific Fleet, although the balance was steadily shifting towards the more versatile Phantom II with its greater attack capability. Excelling in the 'day fighter' role, Crusader squadrons had achieved 18 confirmed MiG kills by the end of Operation *Rolling Thunder*, with three losses to MiGs, compared with ten official kills for the F-4 units and four losses to MiGs.

McDonnell's predecessor to the F-4 Phantom II was the F3H-2 Demon, which equipped VF-14 'Tophatters' from January 1956. The squadron had previously flown the F3D-2 Skyknight from 1954, gaining some pioneering experience in all-weather, radar-equipped interception. VF-14's original 1955 conversion date to the Demon was long delayed by development problems with the F3H. The 'Tophatters' eventually deployed, onboard *Forrestal*, for the first time in January 1957 and made their last Demon cruise in April 1963 before upgrading to the F-4B Phantom II (*US Navy*)

The Phantom II component in a carrier air wing for the larger carriers (*Midway* class and above) usually comprised two squadrons, each with 12 aircraft, although space restrictions often meant that ten would be embarked and two or more retained ashore undergoing repair or kept as spares. For their 1965 cruises, USS *Coral Sea* (CVA-43) and USS *Midway* (CVA-41) paired single F-4B units with F-8D squadrons. Although Crusader 'gun-fighter' pilots remained fiercely loyal to their steeds, many were depressed to see their definitive F-8Es loaded with bomb pylons and equipped with radar that greatly increased the pilot's work-load. In an F-4 there was a Radar Intercept Officer (RIO) to take care of all that. Many pilots also believed that the Phantom II was a better fighter at the medium to low altitudes where most Vietnam War aerial engagements occurred.

Early skirmishes with the North Vietnamese in 1964 developed into the sustained bombing campaign known as Operation *Rolling Thunder* from 2 March 1965, which soon involved the increasing number of F-4B units. Targets were chosen at points advancing progressively closer to Hanoi and Haiphong in order to ratchet up the pressure on the North Vietnamese government.

The *Rolling Thunder* Coordinating Committee selected targets for armed reconnaissance missions followed by pre-planned attacks on fixed points by large formations of combat aircraft launched from several carriers. Known as Alpha strikes, these missions were initially scheduled to be conducted during three-hour periods over the target area to avoid confliction with USAF operations. However, in April 1966 a revised plan drawn up by senior officers in the USAF and US Navy saw North Vietnam divided into six geographical sectors or Route Packages (RPs). USAF and US Navy forces took responsibility for operations over each RP on a weekly rota. Even the smallest targets, choices of ordnance and numbers of aircraft involved were selected and approved by the White House at President Lyndon Johnson's Tuesday lunch meetings with his advisors.

‘Freelancers’ F-4B-06-MC BuNo 148379 waits its turn to ride *Midway*’s starboard catapult as another VF-21 aircraft climbs away. The F-8D Crusader on the port catapult belongs to VF-111, which was the other fighter squadron in CVA-41’s CVW-2 for the 1965 Vietnam cruise that included the US Navy’s first two confirmed MiG kills of the war, both for VF-21, and a third to a VA-25 A-1H Skyraider (*US Navy*)

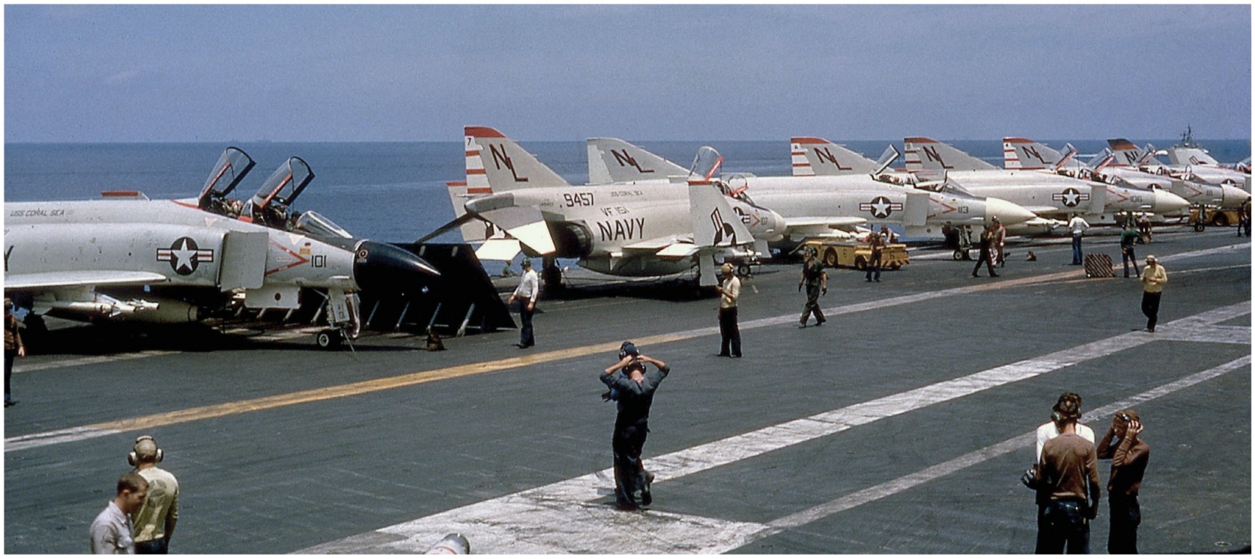
The RP plan was soon modified so that the US Navy had responsibility for the coastal RPs (2, 3 and 4) while USAF tactical wings, flying mainly from Thailand and South Vietnam, controlled the inland RPs 5 and 6A, including most of Hanoi, although US Navy aircraft sometimes operated there too. RP 1, adjoining South Vietnam, was managed directly by Gen William Westmoreland, head of Military Assistance Command, Vietnam, from his HQ in Saigon. Targets in RP 1 were predominantly the USAF’s responsibility, although the area also kept locally based US Marine Corps aircraft busy too. The guiding principle of *Rolling Thunder*, in the words of RADM Malcolm W Cagle (author of *Task Force 77 in Action off Vietnam*), was not to ‘inflict maximum damage on the enemy. Instead, it is a precise application of military pressure for the specific purpose of halting aggression in South Vietnam’. The result was a protracted, immensely costly campaign that impeded North Vietnamese aggression but never halted it.

ALPHA TEAMS

Alpha strikes concentrated a carrier air wing's power into maximum effort 'packages' of up to 35 aircraft, depending on the size and composition of the carrier air wing, from the two or three carriers that were normally on station. Usually, 16 A-4 Skyhawk bombers or fewer A-6 Intruders (from June 1965) were escorted by about ten F-8 Crusaders or F-4s, which included flak suppression flights. *Iron Hand* A-4s (later, A-7A Corsair IIs) preceded the formation to attack radar-controlled flak batteries and missiles, and the force was supported by EA-1 or EA-3B electronic countermeasures aircraft, KA-3B aerial tankers, E-1B Tracer airborne early-warning aircraft and two SH-3 search and rescue helicopters. On smaller 39,000-ton *Essex*/*Hancock*-class carriers, which could not operate F-4Bs or A-6As, the mix was usually 16 A-4 Skyhawk and F-8C/E Crusader bombers, two *Iron Hand* A-4Es carrying AGM-12 Bullpup or AGM-45 Shrike missiles and flying with an F-8 escort, and two F-8 combat air patrol (CAP) flights.

Each CAP included two or four fighters. F-4s performed this role from the 62,600-ton *Midway*-class carriers (*Coral Sea*, *Midway* and USS *Franklin D Roosevelt* (CVA-42)) or the much larger 86,000-ton 'supercarriers', including USS *Forrestal* (CVA-59), USS *Saratoga* (CVA-60), USS *Ranger* (CVA-61), USS *Independence* (CVA-62), USS *Kitty Hawk* (CVA-63) and USS *Constellation* (CVA-64). They were joined in this rotational deployment schedule for Task Force (TF) 77 off Vietnam by the nuclear-powered USS *Enterprise* (CVN-65) in 1965 and, later in the war, by USS *America* (CVA-66).

During their deployments, lasting up to ten months, carriers routinely conducted 'cyclic' operations, with 12 hours of flying followed by an equal period of maintenance and planning. Deck operations were usually timed from midnight to noon (Red schedule), while a second carrier ran its air activities from noon to midnight on the Blue schedule. For regular operations, groups of 20-25 aircraft, including six fighters, were launched in 'events' that were carefully coordinated with recovery times for each group. A stand-down day was normally scheduled after about ten days of operations. A third carrier could fit in its operations to overlap on an 0600 hrs to 1800 hrs 'White' schedule. Alternatively, all three carriers could generate Alpha strikes simultaneously if additional pressure on the enemy was required, as it was in 1972 during Operation *Linebacker I/II*. By 1969 *Midway* was in fact routinely generating four Alphas per day, amounting to an astonishing 150 sorties. Other carriers sometimes reached similar levels of activity.



Sidewinder-armed F-4Bs of VF-151 'Vigilantes' are manned on the flightdeck of *Coral Sea* prior to being launched on the next bombing mission against targets in North Vietnam in mid-1965. They shared CVA-43 with CVW-15's two A-4C/E Skyhawk squadrons, the A-1H/J Skyraiders of VA-165 and VAH-2's A-3B Skywarriors. Fighter duties were performed by VF-151 in conjunction with VF-154 'Black Knights', flying F-8D Crusaders (*Don J Willis*)

An additional role for the TF 77 carriers was imposed in April 1965 – to provide air support for ground forces in South Vietnam. A shortage of airfields for USAF and US Marine Corps tactical aircraft emphasised the importance of the carrier fleet's 'mobile air bases' until enough land bases were constructed. TF 77 aircraft also provided air strikes within the USAF-managed *Barrel Roll* and *Steel Tiger* operations, particularly when poor weather obscured targets in North Vietnam. On those occasions naval strikers and F-4 escorts were managed by 'Panama', the USAF's control centre in Da Nang, and their targets were provided by USAF forward air controllers. From mid-1966 these responsibilities diminished and the arrival of USS *Intrepid* (CVS-11) and *Franklin D Roosevelt* from the Atlantic Fleet enabled TF 77 to keep up to four carriers focused on operations over North Vietnam.

A carrier's deployment was divided into 'line periods', each one lasting for up to 45 days, or much longer if the demands were unusually high or a relief carrier was unavailable. The first line period of four or five days was usually spent on *Dixie Station* in the less threatening atmosphere of South Vietnam to allow crews to get accustomed to the operational environment. Phantom II squadrons gained combat experience there, dropping 500-lb bombs and firing rockets under the direction of a forward air controller (FAC) in support of ground troops, or bombing in formation above cloud on radar-directed missions. A carrier would then move north to *Yankee Station* off Haiphong to carry out attacks on heavily defended North Vietnamese targets.

Time between line periods usually included around ten days in port for rest and recreation for the crew and replenishment for their carrier. Replacement aircraft and crews were provided as required via Naval Air Station (NAS) Cubi Point, in the Philippines. Losses could be heavy – CVW-9, embarked in *Enterprise*, lost eight aircraft during its first month on station from November 1965, and 20 throughout the cruise, including six F-4Bs. At other times the F-4 units suffered less. *Coral Sea*'s first cruise from December 1964, with CVW-15 embarked, was marred by 21 combat losses and two through accidents, although VF-151's F-4Bs remained unscathed.

An Alpha formation approached its target at around 20,000 ft, although former F-4B pilot David Batson recalled that he often escorted heavily laden A-4C Skyhawks that struggled to attain that altitude before reaching the coast at speeds barely exceeding 350 knots. Fortunately, the majority of US Navy missions stayed below 20,000 ft as the USAF liked to control the airspace above that altitude. Greater fuel economy, achievable at higher altitudes, suited USAF strike aircraft making the long journey from bases in Thailand.

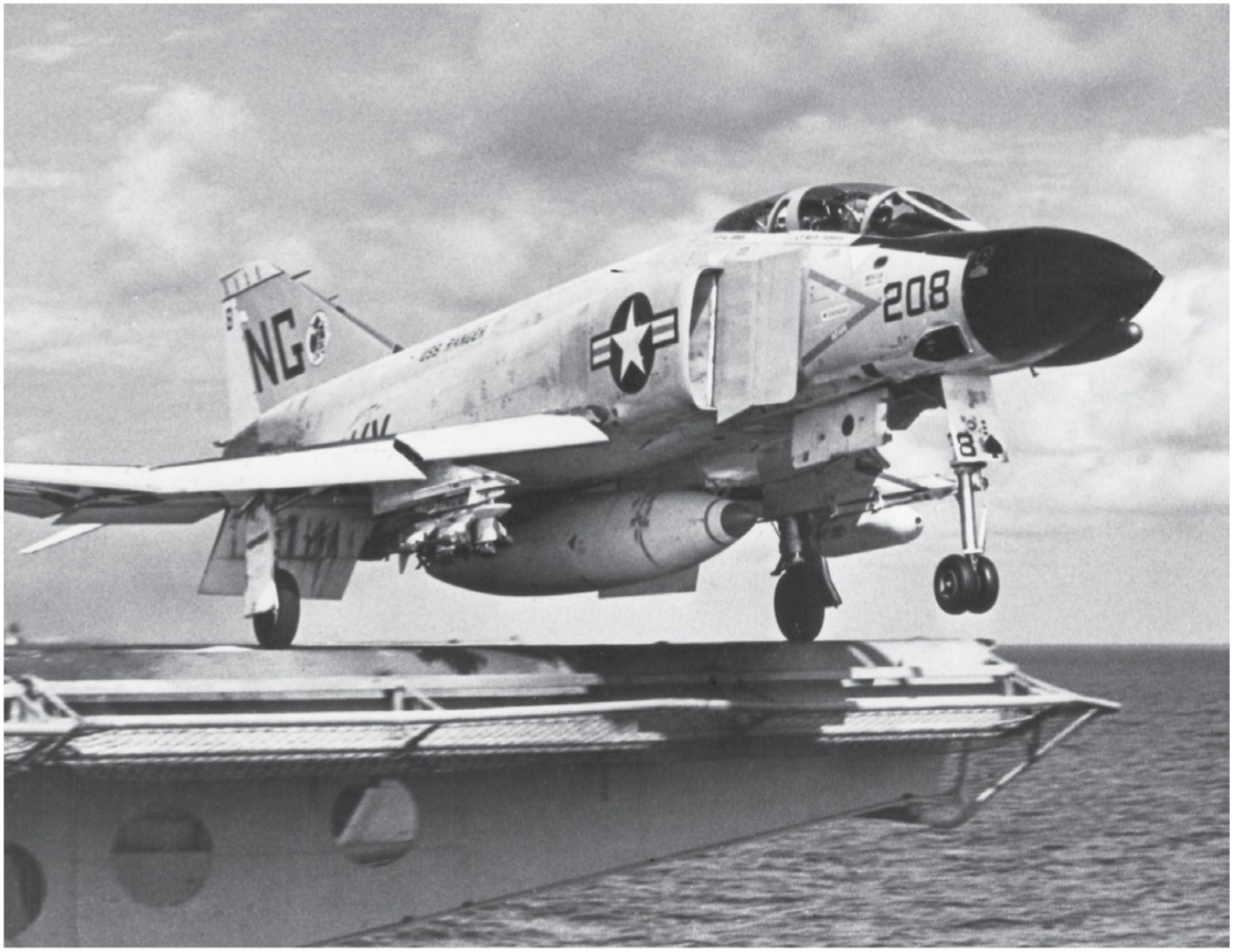
At the top of their 'pop-up' manoeuvre prior to a diving bomb delivery, A-4s would slow to around 200 knots, putting their F-4 escorts at risk from ground defences. Flak suppression Phantom IIs had to aim their ordnance at AAA sites at precise times while the highly agile Skyhawks were manoeuvring to their correct bombing positions. In fact, a clean A-4 could out-turn a MiG-17, and the Skyhawk later proved to be the most realistic MiG simulator in Topgun air combat manoeuvring (ACM) training programmes taught primarily at NAS Miramar. However, flying at less than 350-400 knots put the faster F-4 at a serious disadvantage if it had to try and out-manoeuvre a MiG fighter or SA-2 surface-to-air missile (SAM), both of which became new threats to the strike forces during 1965. Lower airspeeds also assisted the AAA gunners in their task.

With all ordnance delivered, the strike force regrouped and went 'feet wet' over the coast for the relatively short trip to the carrier. A-4Cs, with up to 5000 lbs of bombs and no external tanks, had around 45 minutes' total flying time for their sorties. Many F-4s – 'gas-hog monsters' in the opinion of Jerry 'Devil' Houston, who initially saw combat in F-8s before subsequently becoming a Phantom II MiG killer – would also be seeking a top-up from a KA-3 tanker if they had used their afterburners in combat. Occasionally, if no tanker was available, Phantom II crews would have to divert ashore to Da Nang, in South Vietnam, up to 200 miles from the Task Force, for fuel or because of combat damage. They also had to allow enough fuel to loiter near the carrier while a launch of other aircraft was completed.

DAILY DUTIES – CAPs

Phantom II CAP sorties fell into several categories, of which the least rewarding were the incessant barrier combat air patrol (BARCAP) missions that had to be flown throughout the conflict. After the Tonkin Gulf incident it was decided that TF 77 needed constant aerial protection from the possibility of further surprise attacks – North Vietnamese *Komar* patrol/torpedo boats were a potential menace, especially by night. The only aircraft flown by the small North Vietnamese People's Air Force (VPAF) that possessed the range and ordnance capable of mounting anti-shipping attacks were the eight Il-28 bombers delivered in mid-1965.

Although the Ilyushins were seldom flown, the possibility of attacks on US vessels operating relatively close to the North Vietnamese coast remained. Indeed, on 19 April 1972 a pair of modified MiG-17F fighter-bombers managed to damage the flagship of the Seventh Fleet, the cruiser USS *Oklahoma City* (CLG-5), and the destroyer USS *Higbee* (DD-806). Nevertheless, US Navy BARCAPs and seaborne missiles consistently prevented any other casualties, particularly among the search-and-rescue vessels and radar picket ships that were stationed closest to the shore throughout eight years of war.



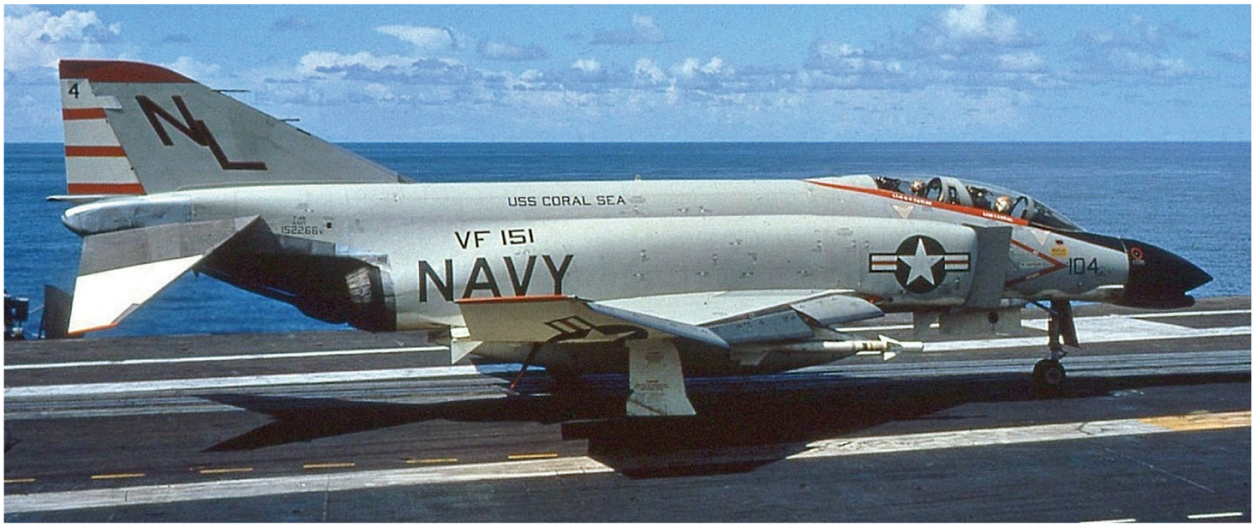
Ranger's CVW-9 for its August 1964 to May 1965 combat cruise included VF-92 'Silver Kings' after the unit's conversion from the F-3B Demon to the F-4B in late 1963. Wearing the unit's early Phantom II markings, 'Silver Kite 208' leaps from *Ranger*'s catapult early in the cruise with an Aero 8A practice bomb carrier (complete with Mk 76 25-lb 'blue bombs') and an LAU-3 rocket pod. In the final month on station CVW-9 experienced the first clash with MiGs, during which one of VF-96's F-4Bs was lost to communist Chinese fighters. The F-4B's nose landing gear is extended here by 20 inches to provide the correct angle of attack for catapult launch (*via Norman Taylor*)

The BARCAP Phantom IIs, which were often the first to launch and the last to return, flew 20-mile-long racetrack patterns up to 130 miles from the carrier and about 25 miles offshore from Haiphong at around 18,000-20,000 ft. They cruised at up to 300 knots in a trail formation, two miles apart and reversed course after only two to three minutes. An hour into the mission the crews would take turns to refuel from a tanker and then resume the circuit until a relief flight appeared. Replacements were sometimes delayed, and many BARCAPs continued for up to six hours of posterior-numbing tedium. BARCAP crews also participated in protecting the USAF's crucial airborne radar control EC-121 *College Eye* aircraft and the EC-121M *Big Look* radar reconnaissance platforms of the US Navy's VQ-

1, although *College Eyes* usually had their own USAF fighter escorts.

These missions, although tedious, were not without risk. VF-92 F-4B BuNo 152297, flying at 25,000 ft as an escort for an EC-121M off the coast near Than Hoa on 18 February 1966, was destroyed apparently by a SAM and its pilot, Lt(jg) James Ruffin, was not recovered. His RIO, Lt(jg) Larry Spencer, became a PoW. Two more VF-92 F-4Bs were lost, with two pilots, in a mid-air collision during a 2 April 1967 BARCAP, whilst a VF-96 F-4B disappeared after diving into cloud during a practice interception against another F-4B – ACM practice was one way of occupying time and excess fuel upon returning to the ship at the end of a BARCAP.

The only chance of variety lay in the slight possibility of MiGs rising to challenge the US Navy fighters. More than one BARCAP edged unofficially closer to shore in the hope of drawing MiGs out to fight. For most of the war the strict Rules of Engagement (RoE) prevented US Navy fighters from engaging MiGs unless their VPAF counterparts made directly threatening moves. Occasionally this happened, and the first three MiG kills by US Navy F-4s did occur during BARCAP flights. Otherwise, BARCAPs placed considerable constraints upon the Task Force's mission schedulers to fill the patrol slots from the small number of available F-4s. Land-based US Marine Corps Phantom II squadrons were sometimes called in to preserve 24-hour coverage off Haiphong. In addition, two Alert Five F-4 crews had to be ready on deck to launch at five minutes' notice and reinforce the BARCAP if necessary. Condition 1 Alert crews were required to remain at two minutes' readiness in their cockpits, with starter carts plugged in and deck crews on alert for immediate launch, day or night.



VF-151's 'Switch Box 104' (F-4B-20-MC BuNo 152266) has just returned from an uneventful CAP mission, its four AIM-7Ds and two AIM-9Bs, together with the usual centreline fuel tank, still in place. F-4s with missiles and empty bomb-racks aboard required fuel loads below 3500 lbs for a safe ‘trap’, although 2300 lbs was a preferable maximum. If a crew had to make a missed approach and ‘go-around’, the aircraft could burn 800 lbs of this reserve, necessitating an emergency meeting with a tanker aircraft if another missed wire and ‘bolter’ occurred (*Don J Willis*)

A target combat air patrol (TARCAP) mission took F-4 crews into the most intense combat situations. Their aircraft were loaded with bombs within the strike force, but they also carried three or four AIM-7 Sparrow and four AIM-9 Sidewinder missiles rather than just the pair of Sparrows in the rear missile wells that strike F-4s used for self-defence. Having delivered its ordnance, the TARCAP flight remained close to the target, ready to block any VPAF fighters that tried to ambush strike aircraft in their most vulnerable situations as they pulled up from their bombing attacks. TARCAPs followed the strike force to protect it as it egressed the target, covering any stragglers from the main formation. The presence of the flight was an important deterrent to VPAF pilots. Indeed, losses among TARCAP-protected strike flights during *Rolling Thunder* were limited to just six jets, while 11 MiGs were shot down by TARCAP fighters during the same period.

Another pair (section) or a flight of four F-4s formed the MiGCAP for a strike in the *Rolling Thunder* period. Fully armed with missiles, these aircraft maintained a racetrack orbit over the coast near Haiphong or above Laos across the route leading to an inland target in RP 6B. As the MiG threat steadily increased later in the war, MiGCAP flights were limited to Alpha strikes, with up to four pairs of F-4s orbiting near the MiG bases. The MiGCAP flight took off near the beginning of the strike formation’s launch cycle, with a dedicated KA-3 tanker, so that it could tackle any airborne opposition en route to the target. The first refuelling normally took place soon after launching, which meant that the F-4s could leave the catapult with the optimum combination of ordnance and a slightly reduced fuel load. Timing the refuelling procedure for an injection of up to 6000 lbs of fuel per fighter was crucial so as to avoid putting the tanker aircraft within range of enemy defences.

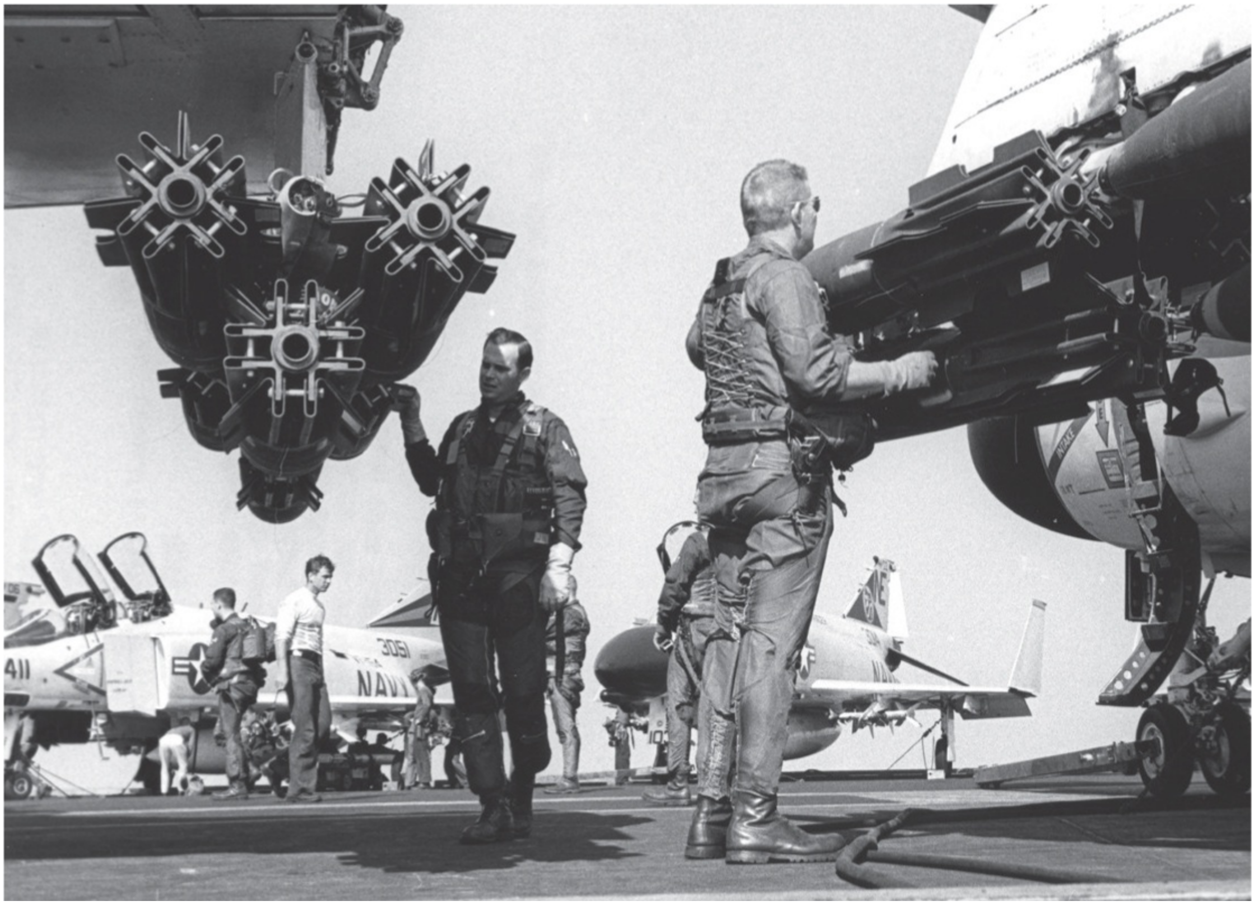
The CAP flight’s purpose was to prevent MiGs from intruding into the strike rather than seeking them out. For this reason a speed of around 400 knots was maintained as the MiGCAP approached its patrol area. The F-4 quickly lost manoeuvrability at speeds below 350 knots, so crews needed a speed advantage to be ready to engage threats by lighting their afterburners. They went ‘feet dry’ over the coast at medium altitude (around 15,000 ft), ready to move quickly and engage threats at higher or lower altitudes.

Although the CAP’s role was to deter MiGs and not chase them in the hope of a ‘kill’, leaving the strike force vulnerable to other attackers, VPAF pilots sometimes did their best to lure CAPs away into tail-chase fights, knowing that a successful engagement brought considerable kudos to any fighter crew. Guidance came from radar controllers onboard ships offshore such as USS *Chicago* (CG-11), using a 'Red Crown' call-sign. They had to communicate with the CAP fighters on a separate frequency to that used for controlling the strike force. As the F-4B had only one two-way radio, this could result in a lack of information about the status of the strike and cause inadequate coordination with strike flights.

Other fighters escorted the RF-8A Crusader or (from August 1964) RA-5C Vigilante reconnaissance aircraft that would follow up the strike to acquire bomb damage assessment (BDA) information. Because targets were within a limited area, CAP and BDA flights often covered attacks by two strike forces that would be coordinated to bomb within a few minutes of each other. Two reconnaissance aircraft were usually required for Alpha operations, and each had its escort to protect it while it made straight-and-level photo runs over the target. With predictable arrival times and flightpaths, the BDA aircraft were particularly vulnerable to enemy defences. Furthermore, the limited view from the RA-5C's cockpits placed greater reliance on an F-4 crew to warn their photo-reconnaissance brethren of threats, particularly from MiGs, and to provide instant Rescue CAP if they fell victim to AAA, SAMs or enemy fighters.

The enemy's defences could be caught out by unexpected changes in tactics. VFP-63 Det 43 RF-8G pilot Lt(jg) Jay Miller from *Coral Sea* and his F-4B escort pilot, Lt Cdr Pete Purvis, were assigned to a 1968 BDA mission just after one of the many Thanh Hoa bridge attacks. They ran the gauntlet of heavy AAA around the bridge but Miller forgot to trigger his cameras. He advised Lt Cdr Purvis that they had to repeat the run, but this time they made it with no opposition as the gunners were not expecting a second pass.

Escort flights (codenamed 'Firecracker') for Da Nang-based Douglas EF-10B ECM/ELINT aircraft were a frequent commitment that could lead to MiG encounters, even at night. On 3 February 1966 a four-ship of F-4Bs flying with two EF-10Bs over North Vietnam were passed by a MiG-17. The enemy fighter was close enough to see the pilot's face and the red star on its tail. Cannon fire was aimed at them and the lead F-4B gave chase, acquiring a radar lock-on and an 'in range' light for his AIM-7 but he could not obtain clearance to fire. Short of fuel (no tanker was available) and approaching the SAM site that the EF-10Bs were monitoring, the Phantom II flight had to abandon the chase.



Armourers complete their work on the F-4Bs of VF-21 and VF-154 onboard *Ranger* while crew members from VA-165 check the Mk 82SE Snakeye bombs on their A-6A Intruders – the Snakeye was regularly employed by Phantom IIs as well. Although it lacked supersonic speed, the A-6A's cruise speed matched the F-4B's, making escort duties easier than they were with the appreciably slower A-4 Skyhawk (*US Navy*)

Escorting the EA-3B 'Queer Whale' could also give F-4 crews an advantage when it came to identify MiG threats. For example, in January 1966 VQ-1 EA-3Bs detected two lock-ons by MiG radars and their escorting F-4s moved in to intercept, only for the VPAF fighters to turn for home.

A trio of F-4B-19-MCs from VF-84 'Jolly Rogers' in November 1964. Six months later the squadron's Phantom IIs, partnered with VF-41's, embarked in CVA-62 with CVW-7 on a Vietnam combat cruise in which five of the carrier air wing's F-4Bs were lost – three of them to AAA on 17 October 1965. Four of VA-75's sophisticated A-6A Intruders from CVW-7 were also destroyed in quick succession, three of them due to premature detonation of their own bombs that were dropped from bomb-racks without an ejector mechanism to thrust them clear of the aircraft in the 0.7 seconds before their fuses armed. Several F-4Bs were also lost in similar circumstances when electrical fuses activated too early (*McDonnell Douglas*)

Flak suppression (known to crews as 'flak absorption') missions were among the most hazardous, but were vital to draw fire from the strike components in an Alpha formation. F-4s armed with bombs and rockets had to fly directly at flak sites, hoping to make the gunners shoot at them and thereby reveal the AAA gun positions. Typical ordnance loads were 12 Mk 82 bombs fitted with somewhat unreliable electric fuses to detonate them in an airburst, causing maximum damage to the AAA site. These fuses were thought to have caused the loss of several A-6A Intruders and at least one F-4B (VF-96's BuNo 150413 on 20 February 1967) through premature detonation caused by electrical interference. However, many of the mechanical fuses in use were of World War 2 vintage, and they too could cause premature detonation.

To deliver the Mk 82s accurately a Phantom II crew had to roll their aircraft onto its back and dive-bomb the site, braving the return fire and keeping the gunners' attention while the strikers prepared to roll in on their targets. They would then revert to a TARCAP role, making them the first aircraft on the target and the last to leave. In the opinion of Capt J C Smith, a RIO involved in the first MiG kill event of the war, flak suppression was 'a ridiculous role for a fighter'. The effect on the AAA batteries was often temporary, and surviving gunners would be back in action within a few minutes, despite the threat of unexploded cluster bombs in their vicinity.

Usually, six more F-4s within the strike package were hung with bombs, capitalising on the fighter's ability to carry twice the bomb-load of an A-4 Skyhawk. Their mission profile was the same as the other A-4 (or A-6A Intruder) bomber aircraft, but they usually carried two missiles for self-defence and they tended to go into the target area before the other bombers so that they were not delayed by the slower A-4s. Intruders, capable of 500 knots with a bomb-load, were more compatible with the F-4B's attack speed.

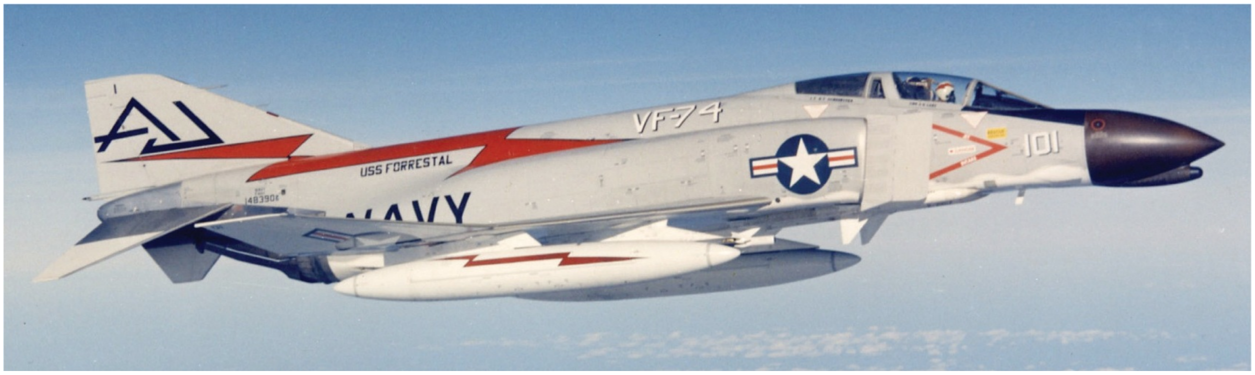
If the mission was aborted over the target, possibly because of poor visibility, F-4 flights often had to remain close to the objective in order to cover the exit of the other Alpha aircraft. Bombs had to be kept aboard while over land as they could only be jettisoned in designated areas of sea. A heavily laden Phantom II orbiting over the target was, therefore, at greater risk from MiGs and SAMs. A 'hung' bomb usually meant a diversion to Da Nang AB to avoid the risk of stray ordnance coming adrift on a crowded carrier deck. In some cases crews flying F-4s with bombs and missiles aboard were told to jettison the bombs if they had to tackle MiGs instead.

Illustrating the predominance of air-to-ground and escort missions for F-4 crews, in 1965 the sorties flown by VF-84's Lt Grover Erickson's between 1 and 23 July included six FORCECAP/BARCAPs, seven strike/flak suppression/armed road reconnaissance missions (the latter against targets of opportunity) and four sorties escorting photo-reconnaissance aircraft or EF-10B or EA-3B ECM jets. His F-4's normal ordnance loads included two or four Mk 82 or Mk 84 bombs and LAU-10/A pods housing Zuni 5-in rockets.

THE WEAPONS – F-4B PHANTOM II

The F-4 was a critically important asset for the US Navy during the conflict in Southeast Asia. This was principally because of its unrivalled versatility – the end result of changing requirements during the design's gestation. The development of long-range, air-launched nuclear missiles soon after World War 2 posed a severe risk for naval forces that still relied on piston-engined interceptors and early jet fighters for defence. These aircraft lacked sufficient speed to meet missile-launching bombers before they could expend their weapons. CAPs, therefore, had to be maintained at a distance from the fleet, facing the direction of likely threats, but the available aircraft (particularly first-generation jets like the McDonnell FH-1 Phantom dating from 1945) had insufficient endurance to make this feasible. They also lacked air-to-air radar and long-range weapons, relying mainly on 0.5-in machine guns.

The Douglas F3D Skyknight, in 1948 the US Navy's first radar-guided jet nightfighter, was an important attempt to match an airborne AN/APQ-35 radar with greater fuel capacity, a two-man crew and (eventually) the earliest radar-controlled, beam-riding missiles. However, it was woefully underpowered, making the jet hazardous to operate from carrier decks. Furthermore, it could not manoeuvre like a fighter. A version of McDonnell's second naval jet, the successful single-seat F2H-2 Banshee, ultimately became the only carrier-operated, radar-equipped fighter of the Korean War.



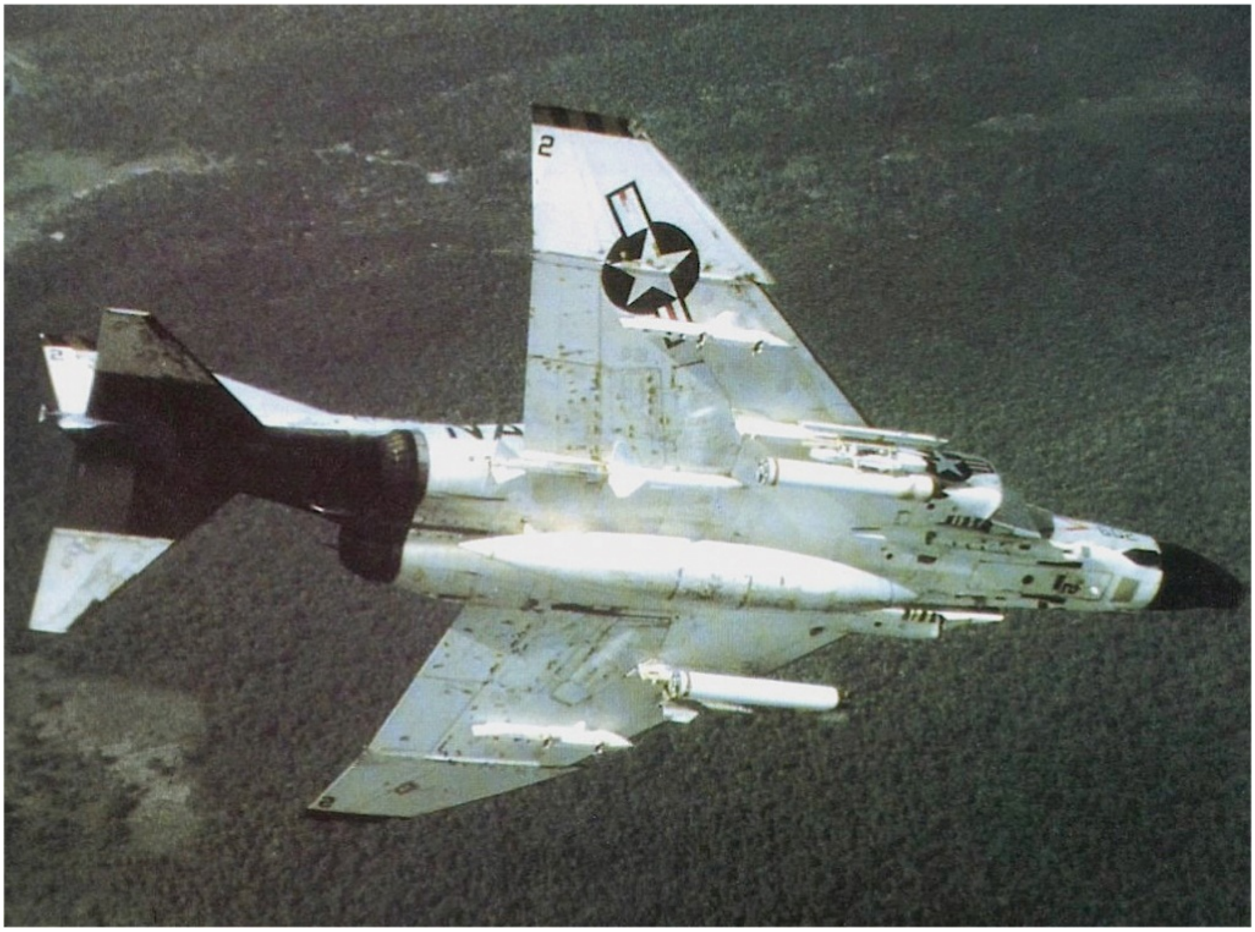
As the first deployable naval Phantom II squadron in 1961 (when this view of F-4B-07-MC BuNo 148390 was taken), VF-74 'Be-devillers' had amassed considerable experience with the F-4 in three peacetime deployments by the time the unit embarked upon its blighted Westpac cruise in June 1967. This early example was assigned to the CO, Cdr Julian S Lake, remembered by Capt Orville 'Tex' Elliott as an impressive leader and innovator who did much to get the Phantom II integrated into naval operations. As 'Tex' recalled, 'Pilots who were to be the cadre of VF-74 were all on their second tours, or first tour with at least one deployment with the F-4D Skyray or F-3H Demon, so the group was handpicked and had already reported to VF-74 when the Phantom IIs arrived at NAS Oceana. Needless to say, the afternoon that the first Phantom IIs landed it didn't take long before Cdr Lake was in the air for the first flight' (*McDonnell Douglas*)

In the rapidly advancing post-war military aviation scene much more was required. Planners foresaw potential attacks by bombers armed with guided nuclear missiles, approaching a naval battle group at 550 mph and 40,000 ft. McDonnell responded with a 1948 proposal for a fighter that incorporated contemporary innovations such as an afterburning engine, swept wings and an all-moving tailplane. Its single-engined F3H Demon had an AN/APQ-50A search radar and in later versions a Hughes AN/APG-51, linked to the AAM-N-2 Sparrow semi-active radar homing air-to-air missile. The aeroplane was intended to provide long-range air superiority, while other new designs such as the Douglas F4D Skyray performed the shorter-range interception mission.

Although the Demon, first flown in August 1951, eventually became a useful, if somewhat unreliable, fighter, its development was crippled by the failure of its intended J40 engine, causing lengthy delays and a re-design that limited production. In some squadrons the Demon became known as 'the pig' because of its unwelcome tendencies, such as losing power in conditions of high humidity, or the tendency of its later J71 engine nozzle to stick in the open position, causing serious power loss. The F8U Crusader was ordered in 1953, giving the US Navy 1000 mph day-fighter capability that would for the first time match anything flying in the USAF. The Crusader's introduction to service left open the future requirement for an all-weather, missile-armed interceptor.

McDonnell's initial sketches for the F3H-G/H project were based on the F3H layout. Single- and twin-engined configurations, initially using the Wright J65 (the British Armstrong Siddeley Sapphire built under licence) were explored. However, the designers expressed an early interest in the General Electric J79-2 turbojet, under development for the USAF's F-104 Starfighter and B-58A Hustler supersonic bomber. Two engines were preferred for supersonic performance and greater over-sea safety. As Vought had secured the US Navy's day-fighter contract, McDonnell, determined to stay in the naval fighter business, worked on a 'general-purpose fighter' that had broader potential, including a substantial attack capability, guns and the option of a single-seat cockpit. Two prototypes of this AH-1 (McDonnell Model 98B) were ordered in September 1954. Crucially, the 'attack' role indicated by the US Navy's chosen AH-1 designation resulted in a total of 11 stores hard-points being included, so that it resembled a supersonic Douglas A-1 Skyraider in terms of its extensive ordnance load.

By June 1955 the US Navy had decided to tender for a heavier, all-weather interceptor (rather than 'fighter' or 'attack') aircraft with a three-hour patrol endurance. The AH-1s were not built but the US Navy continued to support McDonnell's persistent bids for a new contract, and it gave the company a renewed opportunity. Although the US Navy's specification was imprecise, its new 'F4H-1' requirement implied twin engines, long-range radar and internal carriage of a nuclear bomb or missiles. The aircraft was intended to loiter, using one of its engines, and then move supersonically towards any incoming threat to the carrier fleet, launching radar-guided missiles from extending launch rails. A second crew member was required to operate the X-1A radar/fire-control system. McDonnell responded with a revised design that reached the mock-up stage in December 1955, the company's experience in building its two-seat F-101B Voodoo twin-engine, radar and missile-equipped interceptor for the USAF proving valuable during this process.



VF-96 was onboard *Ranger* in the Gulf of Tonkin from 5 August 1964, the squadron knowing this area and its ongoing problems well after it had patrolled the China coast with F8U-2 Crusaders as VF-142 from CVA-61 during the communist Chinese shelling of Matsu and Quemoy in 1959. That visit included an inadvertent supersonic pass over a large communist Chinese MiG base. In the summer of 1961 the squadron learned that it would be the first Crusader unit to get the F4H-1 Phantom II. 'Showtime 602', seen here rolling in on a target during CVW-9's 1964-65 Westpac, is lightly loaded for a combat mission with a pair of Zuni pods and two AIM-7Ds (*US Navy*)

Although the attack requirement, apart from a single tactical nuclear weapon, was removed from the US Navy's needs, McDonnell retained nine of the AH-1's hard-points rather than totally re-designing the wing. The supersonic interception role necessitated aerodynamic changes, mainly to ensure high-speed stability. The outer sections of the AH-1's flat, swept wings were given 12 degrees of dihedral and the wing was thinned overall. Based on a huge one-piece forging, it was originally designed to withstand high-G snap-up manoeuvres for launching free-flight rockets at high-altitude targets. The one-piece tailplane ('stabilator') was given 23.25 degrees of anhedral for better stability at moderate angles of attack and to counteract a rolling motion induced by the outer wing sections. A long vertical fin, low enough to fit carrier hangars without folding, also provided adequate directional stability – a problem in many other contemporary supersonic designs. The outer wing panels folded vertically to save hangar space.

The advent of *Forrestal*-class carriers allowed larger aircraft such as the A-5 Vigilante and A-3 Skywarrior, but the F4H-1 also had to be compatible with the deck lifts of older *Essex*-class vessels, although it never actually served on any of them. The aeroplane's fuselage length was at first restricted to 49 ft, although it was later extended to 58 ft 3 in, with a folding Brunswick-made radome covering the 24-in scanner for the Westinghouse AN/APQ-50A radar that several F3H Demon variants had used successfully. The radar evolved into the AN/APQ-72 for production F4H-1s, with a larger 32-in scanner that required a bigger radome.

The nose area also accommodated a twin-wheel, steerable landing gear that extended by 20 inches to give the correct catapult takeoff attitude. In the tandem cockpits of the early aircraft were Stanley ejection seats with McDonnell survival kits, but in 1957 the US Navy decided to fit more powerful and sophisticated seats since most aircraft accidents were occurring at low altitudes. McDonnell used the British Martin-Baker MB Mk 5 seat, fitted to production aircraft from 1960 and in turn replaced by the upgraded MB Mk 7 with a rocket booster for zero speed-zero altitude performance and a harder seat cushion to reduce spinal compression on ejection.

The otherwise quite conventional cockpit instrumentation included a main radar scope in the rear cockpit and a repeater for the pilot. Rear cockpit flying controls were omitted, although they could be temporarily fitted to some F-4Bs for training. The necessity for low drag at supersonic speeds reduced visibility from the low-profile early F4H-1 rear cockpit, but this was not considered a serious problem since the 'back-seater' had to focus mainly on his radar screen, often under the cover of a sliding hood inside the canopy when the external light was bright. In production aircraft the canopy 'roof-line' was raised slightly. The presence of a second pair of eyes was then found to be a great asset, particularly in combat where the mission was usually very different from the radar-controlled interception of single, high-altitude bomber targets that the US Navy envisaged in the mid-1950s.

Long air inlets flanked the centre fuselage, giving the aircraft its bulky profile and feeding the twin engines via a new, variable-geometry air management system that avoided many of the engine stalling problems that afflicted other fighters. Ahead of the inlet a plate was installed four inches clear of the fuselage to separate sluggish boundary layer air. A second vertical surface was hinged to the rear of the plate, with a slot between the two and 12,000 tiny holes in this rear section to bleed off low-energy air and dump it through louvres above and below the intake duct. This hinged surface swung inwards to restrict the airflow at supersonic speeds – an automatic process controlled in relation to air temperature in the duct.

Bellmouth nozzles near the engine front faces diverted a proportion of the air past the engine to provide cooling and then mixed it with the convergent air passing through the engine and into the afterburner stages. Variable, petal-type external nozzles for the four-stage afterburner sections were hydraulically controlled. Theoretically, the J79 could run for 30 minutes in afterburner below 30,000 ft and two hours at higher altitude, but fuel exhaustion would actually occur within a much shorter time. In the opinion of US Navy MiG killer Guy Freeborn the engines were the Phantom II's 'biggest asset, particularly in situations where the aircraft's handling characteristics were pushed to the limits'.

The F4H-1's flying controls were innovative in being able to manage the aircraft at Mach 2 but also in the critical low-speed conditions required for carrier landings. Its ailerons (or 'flaperons', as they were not conventional ailerons) deflected down by 30 degrees and up by one degree, and they were synchronised with spoilers above each wing that were raised by up to 45 degrees. To bank to the right, for example, the pilot moved his control column in that direction, causing the right spoiler to rise while the left 'flaperon' lowered. Trailing-edge flaps were lowered 60 degrees for landing and 30 degrees for takeoff.

Boundary layer air from the 17th engine compressor stage was blown across the wing through slots at the rear of the leading-edge slats, smoothing the airflow and reducing stalling speed. As part of the process further boundary layer control (BLC) air emerged from slots in the wing just ahead of the trailing-edge flaps at low speeds. This system was incorporated from the eighth aircraft onwards. Carrier approach speed was still around 142 knots – only five knots slower than the 'hot' F-8 Crusader, although the aircraft was stable and predictable on approach, assisted by its electro-hydraulic automatic flight control system (AFCS). This provided stability augmentation and (in conjunction with the autopilot) gave the pilot the option of setting a fixed altitude, Mach number or aircraft attitude. In the early 1960s half of the US Navy's flying accidents occurred during landing, and the F-4's stability, wide-track undercarriage and rapid power response enabled safer carrier recoveries to be made.

The aeroplane was fitted with a heavy, retracting tailhook that was capable of some lateral as well as vertical movement. Centred by coil springs, the tailhook was retracted with a hydraulic actuator. Heavy-duty main landing gear components had relatively narrow 7.7-in-wide tyres, inflated to 350 psi pressure. They wore rapidly when used by land-based US Marine Corps squadrons, who initially got only five landings from a set of main landing gear tyres! F4H-1 main landing gears were also unforgiving in hard carrier landings, occasionally inducing a ‘bounce-roll’ touchdown that could force the undercarriage mount up through the wing skins. The wheels were replaced with wider versions in the later F-4J/S variants.

CDR J.L. FELSMAN U.S.N.
WARNING
CAUTION
WARNING
CAUTION
9L

Cdr J L Felsman and an unidentified RIO pose in the cockpits of F4H-1F (later F-4A) BuNo 145316, which was an early Block 2 production aircraft that had different intake ramps, canopies and radomes from later aircraft. The F4H-1Fs also lacked the transparency between the two cockpit canopies. This aircraft made the first attempt at a low-altitude speed record for the US Navy’s Project Sageburner on 18 May 1961, but a flying control pitch dampener failed causing violent pilot-induced oscillations. Subjected to g loads far beyond its structural limits, the aircraft broke up and exploded, killing Cdr Felsman (*US Navy*)

The first prototype YF4H-1 (BuNo 142259) was completed after nearly seven million man-hours of design and construction, the aeroplane performing its maiden flight on 27 May 1958 from McDonnell’s Lambert Field home. The flight-test programme soon revealed areas in need of improvement. The cabin air intakes on the nose were enlarged and after the first 18 aircraft a bigger radome, raised cockpits and higher canopies were added. Revised straight-lipped air intakes and hinged intake ramps were introduced for the next 45 F4H-1 (later F4H-1F and then F-4A after 1962) models. These also had five attachment points for two LAU-17A inboard pylons, two MAU-12 outboard pylons and an Aero-27A centreline rack that could take ordnance racks or a 600-gallon fuel tank. For aerial refuelling of other aircraft, a standard D-704 'buddy tank' could also be carried. Containing 300 gallons, it could also be used to transfer the F-4's own internal fuel via a hose and drogue. A retractable in-flight refuelling probe was inset into the right side of the cockpit area.

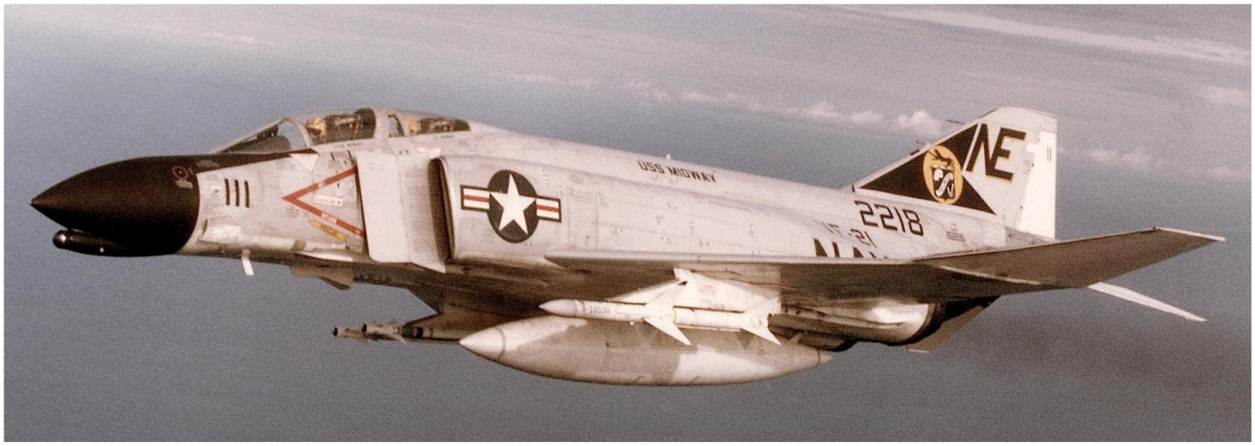
The first definitive production model – a Block 6 F4H-1 – first flew on 25 March 1961, and it incorporated these innovations and many other minor improvements that derived from the extensive US Navy and US Marine Corps F4H-1 flight test programme. During that period the F4H-1 (christened 'Phantom II' by James McDonnell on 3 July 1959) beat Vought's J75-powered, Sparrow-armed F8U-3 Crusader in US Navy Preliminary Evaluation trials. Vought's aircraft was faster, more manoeuvrable and cheaper, but the F4H-1 prevailed with its twoman crew, twin engines and heavier ordnance load. The test programme also extended into a series of record-breaking flights to demonstrate the Phantom II's speed, rate of climb and performance at altitude. From 6 December 1959 to 12 April 1962 US Navy and US Marine Corps pilots attained 15 new world records in prototype and early production F4H-1s. In one of the most spectacular flights Lt Col Tom Miller set a speed record of 1216.76 mph over a 500 km closed circuit course, spending 25.5 minutes in afterburner. At 50,000 ft he hit Mach 2.15 on the final leg, enduring a cockpit temperature of 125 degrees Fahrenheit.

Among the other heroic flights, Lts Hunt Hardisty and Duke DeEsch flew an F4H-1 at 902.8 mph in Project Sageburner for the Absolute Speed Record (below 100 m altitude), averaging 125 ft above the ground. Cdr Lawrence Flint achieved a 98,557 ft Absolute Altitude Record and Lt Col Robinson hit 1700 mph at the end of a Project Skyburner Absolute Speed Record run. Other pilots broke time-to-climb records, including a 12 April launch from a standing start in which Lt Cdr D W Nordberg reached an altitude of 30,000 m in 6 mins 11.43 secs, exceeding 100,000 ft at the apex of his climb. This was a spectacular service introduction for the new fighter and excellent publicity for an international sales drive, although the qualities it demonstrated in these record flights were not necessarily the ones that would bring the Phantom II fame in combat a few years later.

THE WEAPONS – AIM-7

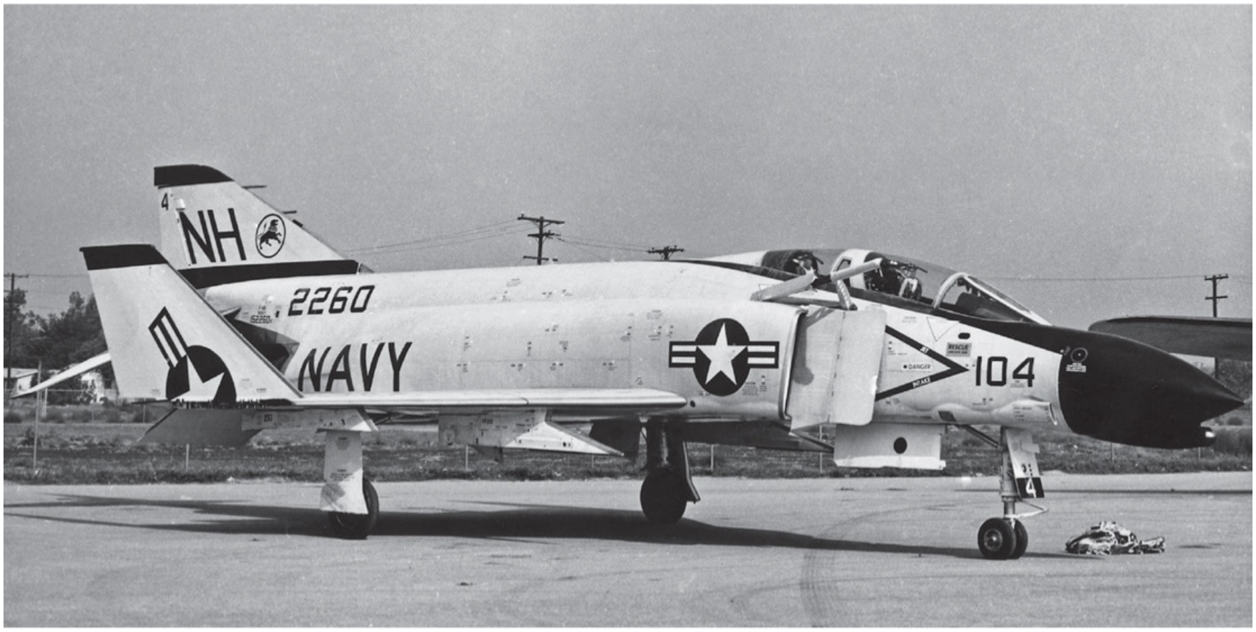
Naval Phantom IIs used two types of missile as their air-to-air armament, with the semi-active AIM-7 Sparrow III being the primary weapon for the aircraft's original fleet defence interception role. Four missiles were semi-recessed in 'troughs' beneath the fuselage, whilst an additional AIM-7 could also be hung under an inboard wing pylon – a configuration that was sometimes used in the 1960s, with two Sidewinders on the opposite pylon. At first, an extending trapeze launcher (used in USAF fighters like the F-102A Delta Dagger) was thought to be necessary for Sparrow launches at speeds above Mach 2, but McDonnell chose a simpler ejector rack instead. Small explosive charges activated pistons to push the missile clear of the aircraft prior to rocket motor ignition. A miniature autopilot in the missile then ensured that it set off on the correct course, rotated so that its fins adopted the optimum attitude for manoeuvring.

The Sperry/Raytheon AIM-7 Sparrow III dated back to the Douglas venture Project Hot Shot in 1946. The resultant AAM-N-2 Sparrow I (AIM-7A) entered limited service in 1956 on F7U Cutlass and F3D Skyknight fighters. In 1951 a new version, the AIM-7C (AAM-N-6) with semi-active homing, a solid-fuel motor and continuous-rod warhead, was developed, entering US Navy service in 1958. Classified as a semi-active missile, the AIM-7C 'rode' a beam of energy transmitted at the target by the launch aircraft's search radar and partially reflected back into the passive antenna on the missile's outer surface. The launch aircraft had to illuminate the target with its radar until missile impact or else the radar lock would be broken. Clutter from heavy cumulus cloud could also break a radar lock.



VF-21's F-4B-21-MC BuNo 152218 with a partial version of the 'interception' missile load-out, including a wing-mounted AIM-7D. In combat, the LAU-17 inboard pylons were usually required for TERs, and additional AIM-9B Sidewinder LAU-7/A rails could also be mounted on the pylon's sides. This Phantom II was later transferred to VMFA-323 and lost in combat on 10 January 1966 when one of its own bombs exploded prematurely during an attack on a VC target near Da Nang (*US Navy*)

The AIM-7D, with a liquid-fuel motor giving a 75 per cent range increase and proximity-fused warhead allowing head-on interceptions, became the principal armament for F4H-1s in 1962. It was succeeded by the AIM-7E, which began production the following year for general use by 1966. AIM-7C/D versions were phased out from 1968. Limited numbers of AIM-7E-2 'Dogfight Sparrows' with reduced minimum launching range, increased manoeuvrability and more reliable fusing entered service towards the end of that year.



Clean apart from its inboard LAU-17/A pylon launchers, this VF-213 F-4B-20-MC has had its in-flight refuelling probe extended (which could be done pneumatically) for routine maintenance. Its storage cavity left no space for the installation of a control or instrument console in the rear cockpit on that side. The probe's extended position gave the RIO a better view than the pilot's of the nozzle contacting the tanker's 'basket'. A red lamp above the *RESCUE* placard beneath the windscreen illuminated the probe at night to aid the crew in 'plugging' the basket accurately. BuNo 152260 later served with VMFA-115, and it was shot down near Hue, in South Vietnam, on 22 January 1969 whilst still assigned to the unit (*via Norman Taylor*)

The AIM-7E was 12.5 ft long and eight inches in diameter, with variants weighing between 450 lbs and 503 lbs. It accelerated to Mach 3.7, moving at 1300 ft per second within two seconds of release. The weapon's range approached 28 miles at high altitude, although this was considerably reduced in the denser air of lower altitudes. Sparrow III was designed to knock out large, high-altitude targets flying virtually straight and level. It was limited to turns of 3g, although this was improved in later versions. Its 66-lb warhead could destroy a bomber-sized target, but two missiles were usually fired to increase the likelihood of a kill. Even slow moving piston-engined biplanes could become targets for a Sparrow, although their cost was a fraction of the missile's.

On 20 December 1966 Lt Hugh 'Rattler' Wisely and Lt(jg) David Jordan of VF-114 and Lt Dave 'Barrel' McRae and Ens David Nichols of VF-213 were scrambled from *Kitty Hawk* to investigate a radar plot 25 miles northeast of Thanh Hoa. It was early morning and visibility was poor, but the plot was assumed to be hostile, so they were cleared to fire AIM-7Es. The ensuing explosions marked the end of two 150-mph Antonov An-2 'Colts' that were probably flying off-shore radar calibration sorties. Lt Wisely completed 350 combat missions and made 850 deck landings in three VF-114 tours. He later commanded two fighter squadrons and the *Blue Angels* before taking command of the carrier USS *John F Kennedy* (CV-67) in 1988.

Two more An-2s, firing rockets at South Vietnamese boats at night, were almost certainly downed by VF-142 and VF-143 F-4Bs on 14 June 1966, also with AIM-7Es. This, the first nocturnal engagement of the war, managed by USS *Coontz* (DLG-9), was complicated by the two F-4Bs losing radar contact with the target and also having to make 360-degree turns and re-runs at the An-2s to avoid firing missiles at each other. Although initial radar contact was made at around 15 miles after the F-4Bs had jettisoned the LAU-3/A rocket pods and Mk 24 flares that they also carried, one of the Phantom II pilots had to close until he could see the red cockpit lighting inside one of the An-2s before he could guess at their identity.

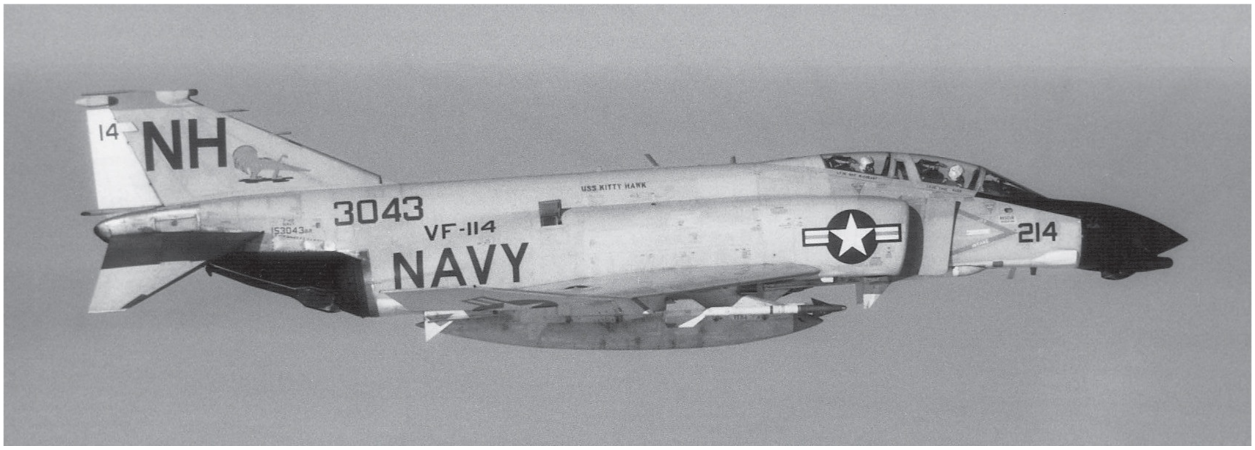
For production F4H-1s, the fire-control components for this radar-controlled missile system were concentrated in a single package behind the scanner, as they had been in the Douglas F4D Skyray's Aero 13F system, rather than scattered around the airframe as in previous fighters. The main body was mounted on a sliding I-beam rail for easy maintenance access. The Westinghouse APQ-50A, used in the Skyray, was modified by Raytheon to operate with its Sparrow III missiles and specified for the 'general purpose' AH-1 as it evolved into the F4H-1. Missiles and radar were linked by an AN/APA-128 continuous-wave system so that radar returns from the target were passed to the Sparrow III missile's own small radar scanner and also to 'B-scope' radar displays in the aircraft's cockpits. In the rear cockpit the RIO's screen displayed the target information as three dots – a centre dot, with range-to-target indicated on a vertical scale and bearing-to-target on a line at the base of the display. Using this information, the aircraft could be steered to the optimum location for a missile launch.

THE WEAPONS – AIM-9

Two of the hard-points that had been retained for the F4H wing design were soon required for underwing pylons when it was decided in May 1956 to use the AAM-N-7 (AIM-9B after 1962) Sidewinder heat-seeking missile as secondary armament. Interception tactics then required a head-on attack with AIM-7s followed by a reverse turn and a rear 'pure pursuit' attack, if required, using AIM-9s.

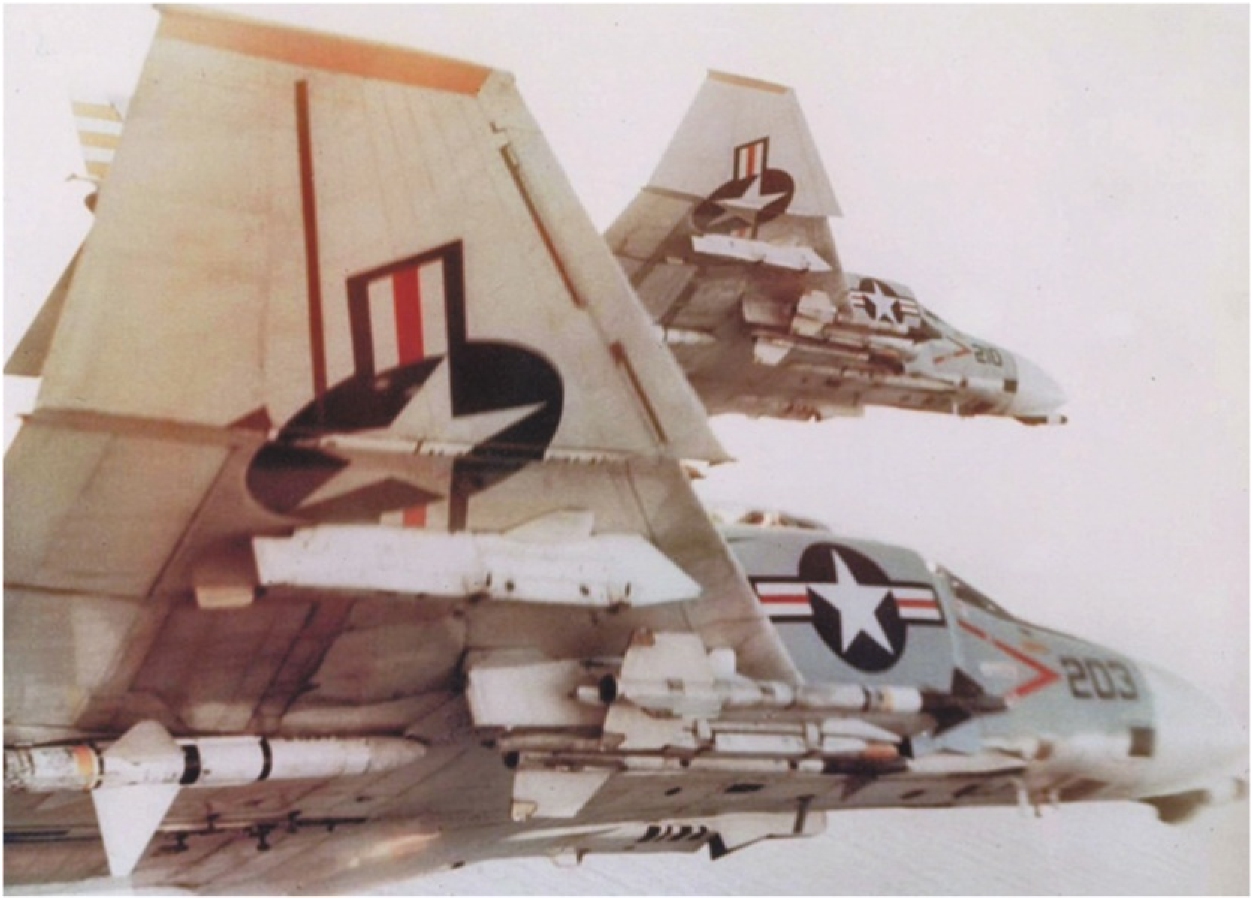
Dating back to 1951, this comparatively simple weapon was at first a 'side project' for US Navy physicist William McLean, working at the Naval Ordnance Test Station at that time. He proposed that a lead-sulfide (PbS) infrared seeker head on a basic, solid-fuel rocket could detect enough heat from a jet engine's efflux to guide the weapon towards the heat-source. The US Navy, heavily involved in funding development of the AIM-7 Sparrow III, eventually began to express an interest in this low-cost, short-range missile in 1953 when early tests were successful. It went into limited production as the Sidewinder 1 in 1956, followed in 1957 by more than 71,000 copies of the AIM-9B Sidewinder 1A version, which was also ordered by the USAF as the GAR-8/AIM-9B.

The weapon's 9 ft 4 in tubular body contained a 10-lb Mk 8 blast fragmentation warhead with a Mk 304 infrared proximity fuse (plus a Mk 303 contact fuse) and an Aerojet Mk 17 rocket motor. Wings spanning 22 inches were attached to the tail, with 15-in fins on the nose section. AIM-9Bs had to be launched from directly behind a strong heat source from a target flying virtually straight and level. Its range was around 10,000 ft and it could reach Mach 2.5.



VF-114 F-4B-27-MC BuNo 153043 has a full missile load for a CAP mission, its weaponry consisting of four AIM-7E Sparrows and four AIM-9D Sidewinders, plus a centreline fuel tank. It also has the AN/APR-30 ECM fit and Tracor AN/ALE-29A chaff or flare dispenser, for which the open door can be seen ahead of the squadron designator. Each plastic 'bucket' (one each side of the aircraft) held 30 shotgun cartridge-sized chaff containers or flares that could be fired, using a selector panel in the rear cockpit, singly or in salvoes to confuse enemy radars or missiles. Pilots were advised to close the doors after use to avoid damage to the fuselage skin aft of the compartment. This F-4B was lost in a midair collision with another VF-114 Phantom II on 11 April 1968, but all four crewmen were recovered (*US Navy*)

The US Navy then ordered the improved but similar-looking AIM-9C with a semi-active radar-homing seeker head and a 22-lb continuous-rod warhead, followed by the re-designed AIM-9D in 1964. The latter's new components included a nitrogen gas cooling system to increase the sensitivity of its infrared seeker head. A new LAU-7 launcher rail containing a bottle of nitrogen gas was also provided. Powered by a Thiokol Mk 36 rocket motor, the AIM-9D and its AIM-9G successor of 1968 were identifiable by a dark, anodised nose section of more tapered appearance. The AIM-9G also introduced the off-boresight Sidewinder expanded acquisition mode (SEAM) that allowed the missile to be aimed from a much wider angle behind its target.



AIM-7E and AIM-9D missiles arm these VF-142 'Ghostriders' F-4Bs. Some of the Sparrow system's shortcomings were first highlighted in the earliest MiG encounters. After his 17 June 1965 victory Cdr Lou Page commented that 'switchology is a concern in getting the Sparrow ready. The normal procedure is to tune the Sparrow and put it in "standby". When ready to fire, two switches have to be thrown – CW [constant wave] and ARM, with a short interval between each operation. More automatic switching is desirable in times of high stress.' The system remained much the same throughout *Rolling Thunder* (*US Navy*)

AIM-9Bs and AIM-9Ds were used throughout Operation *Rolling Thunder*, sometimes in mixed loads when there was a shortage of AIM-9Ds in-theatre. In 1967 the use of AIM-9Ds increased the US Navy's missile kill rate to 16 per cent, but out of 30 missiles fired in the last five months of the year (including 21 AIM-7Ds) only five scored confirmed kills. The AIM-9D was found to be better able to track targets against a background of terrain, as Lt Bill McGuigan found on 13 July 1966 when he fired one successfully at a diving MiG at an altitude of around 1000 ft.

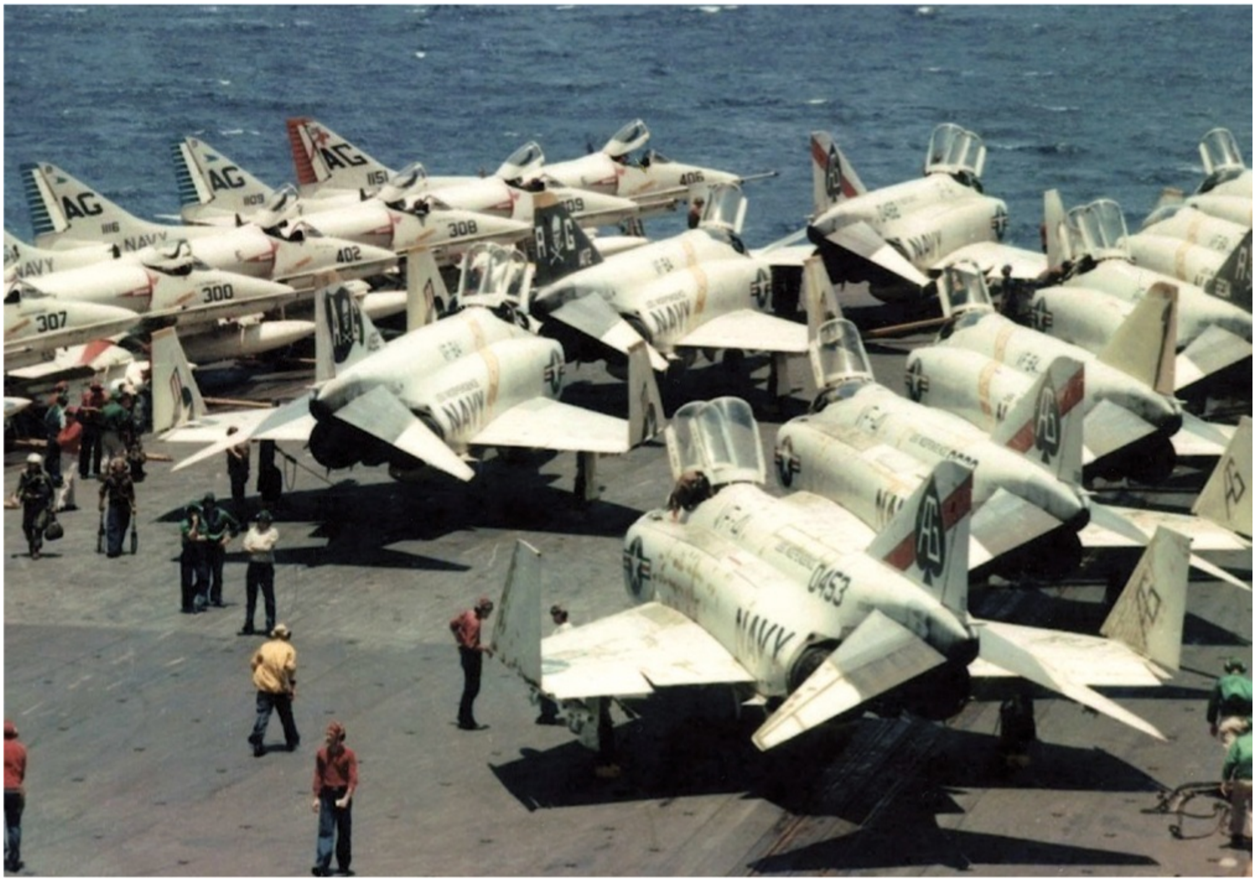
Sidewinders were sometimes used against heat-emitting ground targets of opportunity such as motor vehicles when crews were returning from an escort mission that had yielded no aerial opposition. F-4 crews on night missions occasionally used one to knock out a searchlight battery that had illuminated them over a target area. Both AIM-7s and AIM-9s were sometimes fired at North Vietnamese boats that were attempting to capture aircrew who had ejected close to the coast. The rescue of Lt Cdr Chris Christensen and Lt(jg) Lance Kramer of VF-92, shot down by VPAF ace Nguyen Van Coc five miles offshore on 7 May 1968, required an AIM-7 and two AIM-9s from other 'Silver Kings" F-4Bs to keep intruding junks at bay – not quite what the missile's designers had envisaged.

An ACF Industries AAA-4 infrared sensor pod was added under the F4H-1's radome to widen the 'vision' of early AIM-9Bs. It was linked to the aircraft's airborne missile control system (AMCS) to provide the weapon with initial directional information, but it was a passive system with a six-inch diameter IR seeker head cooled by liquid nitrogen. The expensive seeker would burn out in a few seconds if the nitrogen supply was exhausted. AAA-4 was intended to increase the effective range of the AIM-9B, but it was used very little and soon made redundant by improvements in the Sidewinder. The pod was then used to house early versions of internal ECM equipment and eventually removed in the F-4J version.

Overall control of the missile system, the engines, fuel system and air intake ramps was managed by the Garrett A/A 246 central air data computer (CADC), linked to the Lear AJB-3 twin-gyro bombing and navigation system. Conventional level- and dive-bombing or nuclear-type toss-bombing modes were available, using manually entered data for ballistics and target coordinates. Nuclear ordnance release was calculated automatically if the pilot kept two dots centred on each other in his screen and 'pickled' the weapon when an audible tone was heard in his headset.

THE WEAPONS – BOMBS AND ROCKETS

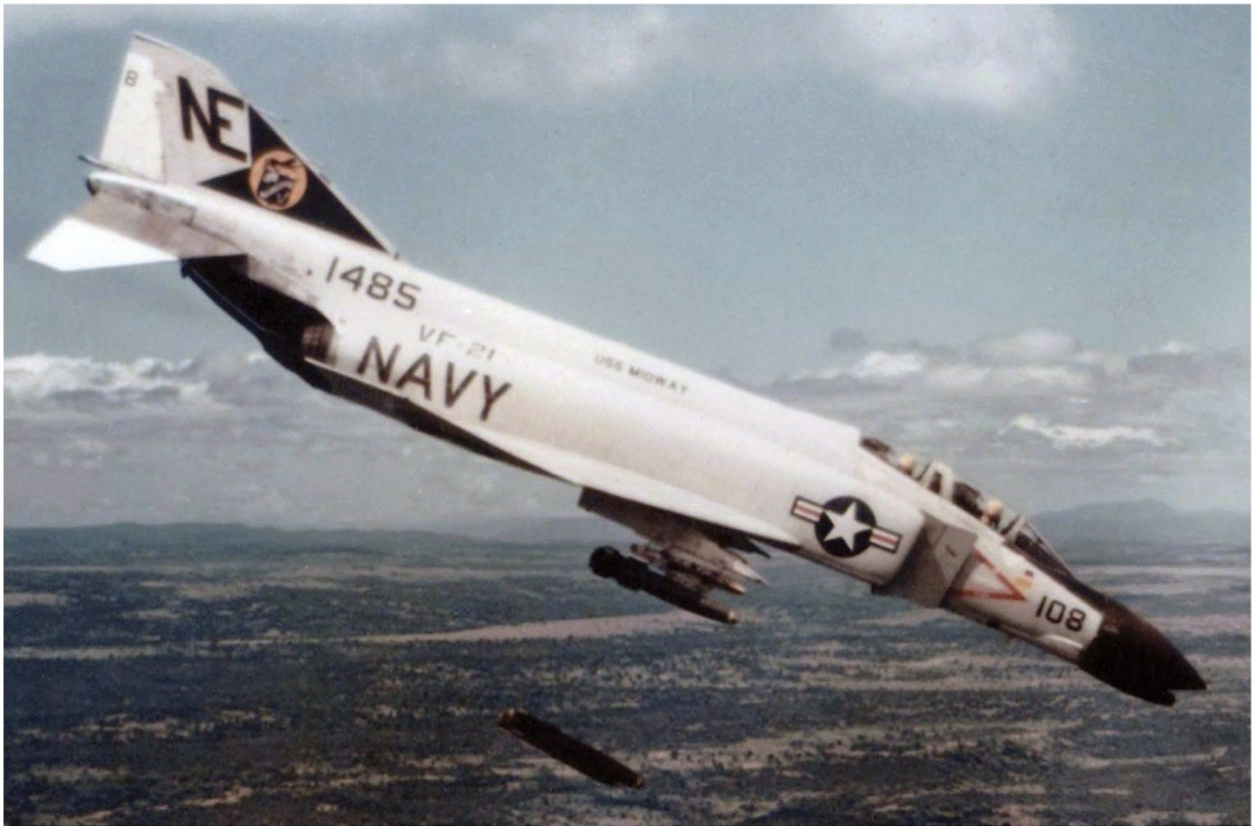
Although F-4s usually carried at least some of the air-to-air weaponry that had given them their original raison d'etre, most of their combat missions in Southeast Asia required air-to-ground ordnance in keeping with traditional US Navy air warfare attack traditions. The carriage of large conventional loads such as M117 750-lb GP bombs limited maximum speeds to around 475 knots, and from late 1965 the US Navy urgently requested types of externally carried weapons that could withstand speeds of up to 600 knots. Often, a mixture of ordnance was uploaded, depending on the mission requirements.



F-4Bs of VF-41 and VF-84 fill *Independence*'s deck during CVW-7's 1965 cruise. The A-4E Skyhawks of VA-72 and VA-86 carry AGM-12B Bullpup missiles or bombs while the F-4Bs' MERs await ordnance. VF-84's skull and crossbones tail markings acquired a solid black background during the cruise. The inherent hazards of so much ordnance, fuel, jet exhaust heat and intensive action in such a confined space occasionally took their toll, most obviously aboard *Forrestal* in July 1967 (*McDonnell Douglas*)

In the second half of 1965 typical loads for CVW-7 Phantom IIs (from VF-41 and VF-84) embarked in *Independence* were eight Mk 82 bombs with M139(I) fuses or four LAU-3/A 19-shot rocket pods together with two LAU-10/A pods housing four five-in Zuni rockets each. The majority of the ordnance loaded onto multiple ejector racks (MERs) and A/A37B-5 triple ejector racks (TERs) for the F-4s' pylons were Mk-series low-drag, general-purpose bombs. Fuses could be fitted in the nose or tail of the bomb, with an automatic delay of around four to five seconds after release before the bomb was armed. Occasionally bombs detonated prematurely, either through contact with another bomb on release or because the fuse was activated too early. VF-92 F-4B BuNo 151409 was badly damaged by the explosion of a Mk 82 in this way on 2 December 1965. The crew, Lt T J Potter and Lt(jg) C W Schmidt, had to eject from their blazing Phantom II.

The 250-lb Mk 81, fitted with an M904 fuse and conical fins, was typical of the smaller bombs. Like the larger 500-lb Mk 82 Mod 1 bomb that was commonly carried, the Mk 81 could be fitted with an M1A1 'daisy cutter' fuse on a 36-in extension pipe that was screwed into the nose of the bomb. It increased the spread of shrapnel from the exploding bomb rather than allowing it to detonate less effectively below ground. 'Daisy cutter' Mk 82s were often loaded onto one of the F-4Bs in a flak suppression flight, with Zuni rockets on the other aircraft. Mk 82s were routinely fitted with the Mk 15 Snakeye tail fin assembly that extended at 90 degrees in four sections to form an airbrake. This allowed the weapons to be dropped at lower altitudes without the risk of shrapnel damage to the aircraft.



Mk 82SE Snakeye 500-lb bombs fall from the TERs of VF-21 F-4B-19-MC BuNo 151485 during the squadron's 1965 Vietnam cruise onboard *Midway*. Later transferred to VF-92, this Phantom II was shot down by an 'Atoll' missile fired from a MiG-21 that had evaded the usual US Navy radar warnings during a CAP near Vinh on 7 May 1968 (*McDonnell Douglas*)

The 1000-lb Mk 83 was the largest bomb in general use by US Navy F-4s, although USAF Phantoms II also used the 2000-lb Mk 84. Mk 83s were usually carried singly on MERs on the outboard pylons of US Navy Phantom IIs. The Mk 83 was favoured for strike missions, but during the bomb supply shortages of 1966-67 F-4s were often seen with small numbers of World War 2-vintage 125-lb or 250-lb high-drag fragmentation bombs underwing. M117 750-lb GP bombs were also delivered to carriers like *Kitty Hawk* during 1967.

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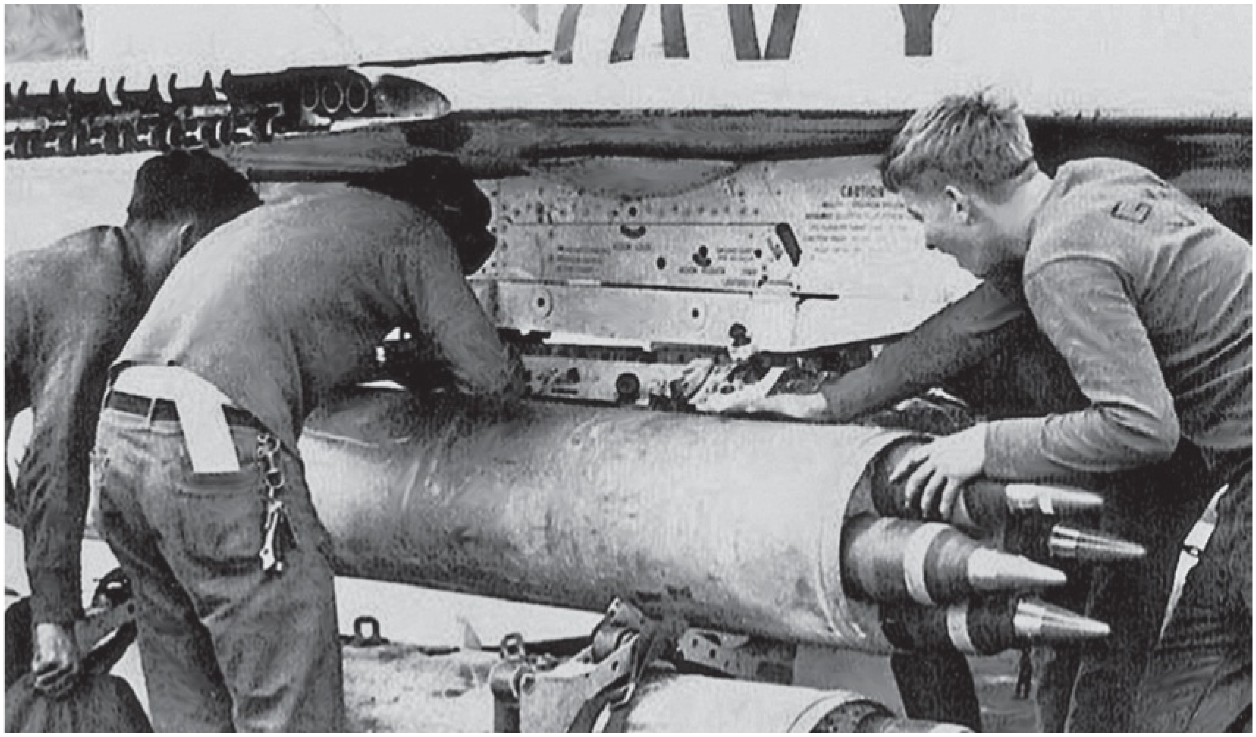
Zuni 5-in rocket projectiles blaze a trail from VF-143 'Pukin' Dogs' F-4B BuNo 151408 over the South China Sea on 25 August 1964. The squadron was embarked in *Constellation* at the time, undertaking its first combat cruise which ended in February 1965. The 'Dogs' made six further wartime deployments, three of them onboard CVA-64 (*US Navy*)

Ordnance loads for 'in country' (South Vietnam) missions could also include Mk 77 Mod 4 firebombs (napalm) or a slightly more accurate finned version of this weapon. The Mk 77 contained around 70 gallons of benzene-petroleum mixture and polystyrene beads, detonated by white phosphorous igniters in the nose and tail when the weapon burst on impact with the target. An F-4 pilot from CVW-15 even suggested using napalm followed by Mk 82s to ignite a huge stack of coal, unloaded from Polish ships near Cam Pha, starting a colossal blaze. Official approval was not offered. After major fires aboard *Forrestal* and *Enterprise* napalm was removed from carriers. F-4s frequently carried rocket pods for air-to-ground missions, including the ubiquitous but rather inaccurate 2.75-in folding-fin aircraft rocket (FFAR) in 19-tube, treated paper LAU-3/A launch pods that weighed 500 lbs when loaded. Seven-tube launchers such as the LAU-32/A were also used. The pods had optional, frangible, drag-reducing shaped paper nose and tail caps, but these were seldom fitted.

Greater accuracy and destructive force could be achieved with the 5-in-diameter, folding finned Zuni rocket, carried in either two-shot LAU-33 launchers, mounted on the LAU-7 Sidewinder launch rails, or in treated paper LAU-10/A four-tube launchers. Its *Rolling Thunder*-era Mk 16 solid-fuel motor units drove the 120-lb missile at more than 1000 mph, delivering fragmentation, high-explosive or incendiary warheads weighing around 60 lbs. Originally designed as an air-to-air weapon (and used to down a MiG-17 by A-4C Skyhawk pilot Lt Cdr T R Swartz), the Zuni was particularly useful for flak suppression. Indeed, it was feared by North Vietnamese gunners. VF-96 was among the squadrons that favoured Zunis rather than bombs for that type of mission.

From 1968, F-4 crews could also use the Mk 20 Rockeye II in a Mk 7 cluster bomb unit dispenser, developed (like the Zuni and 2.75-in rockets) at the US Navy's China Lake Naval Air Warfare Centre Weapons Division. This 511-lb weapon held 247 Mk 118 dart-shaped sub-munitions that could penetrate armour up to seven inches thick.

The F-4's extraordinary power and comprehensive suite of missiles made it an ideal fleet defender, but its ability to carry twice the bomb-load of a World War 2-era B-17 Flying Fortress also meant that it would frequently be used in the principal role of carrier aviation – ground attack. In 1968 a far-reaching report by Capt Frank Ault covering the use of the F-4 commented on the predominance of air-to-ground missions as a reason for the erosion of air-to-air skills and the F-4's comparatively modest performance against North Vietnamese MiGs during *Rolling Thunder*.

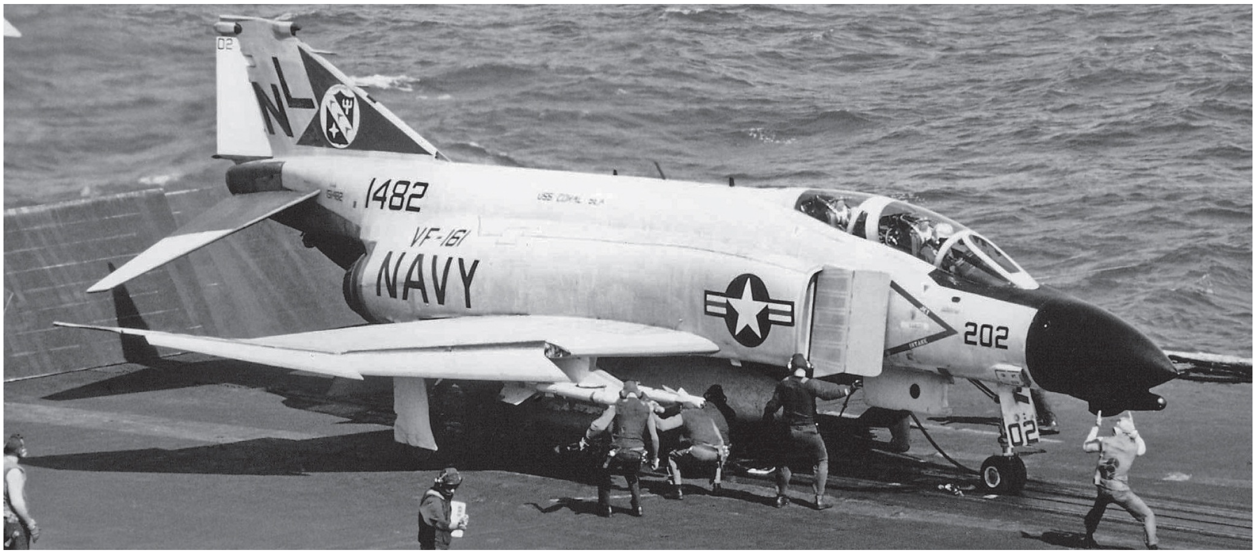


Loading 5-in Mk 32 Zuni folding-fin rockets into an LAU-10/A launcher mounted onto an F-4B. More than six feet long and weighing almost 80 lbs, the unguided projectile could reach 1600 mph over a five-mile range (*US Navy*)

CHAPTER TWO

INTO THE CAULDRON

Many F-4B pilots embarking on Southeast Asia cruises in 1964 approached a conflict for which their training had given them little relevant preparation for most of the missions they would have to fly. Crews trained with VF-101 at NAS Oceana, in Virginia, had been expecting to undertake Mediterranean cruises that would have seen them primarily intercepting prowling Russian Tu-95 'Bears' and Tu-16 'Badgers' and escorting them away from the fleet. At Miramar, on the west coast, VF-121's training syllabus anticipated similar tactics against Soviet bombers patrolling the Sea of Japan. Indeed, some US Navy and US Marine Corps Phantom II crews flying in that area of the Western Pacific were able to observe at close quarters formations of up to 80 Russian bombers practising simulated mass launches of anti-shipping missiles at vessels of the Seventh Fleet.



Flightdeck crew tend to F-4B-19-MC BuNo 151482 aboard *Coral Sea* in January 1968. This was VF-161 'Chargers" second combat cruise embarked in CVA-43, and it cost CVW-15's two Phantom II units (VF-151 was VF-161's sister-squadron throughout the conflict) eight F-4B losses in 132 days on the line, including two to MiG-17s. However, both units prevented many more losses through its CAPs for Alpha strikes on some of the most heavily defended targets in the Hanoi and Haiphong areas, including airfields, bridges and shipyards. BuNo 151482 survived this attritional deployment, and a further 15 years of fleet service, until it was retired to MASDC in September 1983. Subsequently converted into a QF-4N drone, the jet was expended in a missile test on 20 July 2004 (*US Navy*)

However, by the end of 1963 there was a growing realisation that the F-4's principal function as a beyond visual range missile platform might not be relevant if an air-to-air war developed over Laos and Vietnam. It was clear that the RoE would require visual identification of potentially hostile aircraft in order to prevent accidental shoot-downs of other US aircraft, or even of intruding communist Chinese fighters. This obviously denied the F-4 its single greatest advantage in being able to fire a Sparrow head-on, well before the target aircraft could see the threat. It severely impeded air-to-air operations by F-4s of all three US services throughout the war.

The careers of former Skyray and Crusader pilots had been rooted in single-seat, day fighter air combat tactics that focused on gunfire at close range in a stern chase, while most Demon 'drivers' had experience of radar-guided weapons. When those pilots transitioned to the F-4 they all had to adapt to a two-seat crew concept in a fighter optimised for sophisticated missile-armed interception. A new teamwork approach was needed to cope with the prospect of more traditional aerial combat too. Pilots had to learn that their best 'wingman' was probably sitting right behind them and quite capable of playing a key role in any fight, or even directing it.

However, the influx of former Crusader and Skyray pilots brought 'dogfighting' skills to the new F-4 units. There was increasing awareness that ACM should still be part of combat training, and it was included in VF-121's courses from mid-1965. Pilots at that time made around six ACM flights against other F-4Bs and two flights as a pair against two TF-9J Cougar trainers. They also tried to fit in a little unofficial ACM during other sorties within their 50 flying hours of training, although this was generally discouraged, partly to prevent losses of the new, extremely costly Phantom IIs. VF-101 still prioritised long-range interception, with about five practice sorties using smoke bombs to learn ground attack. This tended to encourage squadrons to develop their own ACM training, which could be very different from other units' methods.

Lt Cdr Ken Baldry recalled that his squadron, VF-96, was one of the first to emphasise ACM, and their CO in 1966, Cdr S O 'Lefty' Schwartz, 'changed the face of Phantom II flying to a very large degree. When he took command he and I were the only two F-8 experienced pilots in VF-96. He immediately said, "We are taking off the tanks and MERs and TERs and we are going to find out what the bird will do." Most of the pilots took to the idea like ducks to water, and I cannot ever remember having more fun than taking a clean F-4 all the way out to the edge of the envelope and sometimes a bit beyond. Fortunately, the F-4 is a totally honest machine and it will literally beat you to death in heavy buffet before it stalls. When it does stall it "falls through" fairly predictably so we had a lot of departures and recoveries, but no stall-spin events.'

VF-161, the last Demon unit to convert to the F-4B, also introduced ACM as a priority after visits by squadron members to Air Development Squadron VX-4 in 1965-66, where the lessons of Vietnam aerial combat were already being absorbed and incorporated into training documents. Often the improvements could be quite basic. The limited pre-war ACM training was usually performed at altitudes above 25,000 ft rather than at the realistic combat altitudes of 3000-6000 ft that would be typical of Vietnam engagements. Although the lower altitudes left little room for recovery in emergencies, they were gradually approved for squadron training from 1967 onwards.

As tactics developed it was clear that speed had to be kept as high as possible in an engagement against more nimble fighters, with 450 knots as the minimum patrol speed. Crews who had not experienced the F-4's full flight envelope discovered that the aircraft could stall and lose control at high angles of attack if the ailerons, rather than just the rudder, were inadvertently used to initiate a turn. Speed deteriorated rapidly as the turn tightened and buffet increased, leading to wing-rock and eventually to a stall. With full roll control applied the aircraft could depart from stable flight with as little as 1.7g on the airframe. Failure to appreciate this characteristic led to numerous accidents during the F-4's worldwide career.

The first operational F-4B loss in Southeast Asia occurred as early as 13 November 1964 when VF-142 aircraft BuNo 151402 stalled and entered an unrecoverable spin during strenuous manoeuvring. Lt W R Moore and Lt(jg) W M Myers were rescued safely. Guy Freeborn observed that VF-142's training programme had contained no real ACM component until he re-wrote their syllabus after joining the squadron as Training Officer in August 1966.

Eighteen months later similar mishaps were still occurring within TF 77. For example, on 6 April 1967 VF-114's Lt(jg)s F A Nutting and M L Tuft had to eject from F-4B BuNo 152999 after a stall-spin/'adverse yaw' incident during a training flight from CV-63. Knowledge of the problem tended to make some pilots over-cautious in manoeuvring their aircraft during air-toair engagements until the improved training brought by the Naval Fighter Weapons School's Topgun courses from March 1969 showed them how far they could push their Phantom IIs without departing from controlled flight. Learning to fight 'in the vertical plane', using the aircraft's brute force to defeat its opponent, was a vital skill that started to develop in the mid-1960s.

The F-4B accelerated best with zero g on its airframe, and its optimum turning speed was between 450 and 500 knots. Heavy fuel consumption at high speed and low altitude limited the potential time of an engagement considerably. The aeroplane was also found to be nose-heavy, particularly when landing and during catapult launches, when full 'back stick' was needed unless the aircraft was at maximum gross weight, pushing the centre of gravity further aft. However, it was also possible to over-rotate the aircraft as it left the catapult and stall it. Lt(jg)s Tom Steimer and M L Tuft from VF-114 crashed F-4B BuNo 152997 in this way shortly after being launched on an armed reconnaissance from CV-63 on 8 May 1967. The pilot was killed, but Tuft, who had survived the stall-spin/'adverse yaw' incident mentioned in the previous paragraph, successfully ejected.

VF-101 and VF-121 initially received 45 F4H-1F (F-4A) Phantom IIs to begin the massive training programme, including carrier qualifications. These non-operational variants were followed by the first batch from the F-4B production run of 651 aircraft. The B-model jets incorporated many improvements, with one of the most significant (according to F-4 Support Programme Manager John J Harty) being the new main landing gear that was stressed to a maximum weight of 54,600 lbs. A more obvious innovation was the addition of a Naval Flight Officer (NFO) in the rear cockpit with equal or superior rank to the pilot. McDonnell's own term 'Radar Intercept Officer' soon replaced the NFO title, which in turn had replaced the less prestigious Naval Aviation Observer on 1 May 1965.

The first cadre of 19 RIOs began training at James Connally AFB, in Texas, in August 1959 using a World War 2-era B-25 Mitchell in which they learned to coordinate the view of another target B-25, seen from the aircraft's gun turret, with images of the same aircraft presented on their radar screens in the rear of the bomber. This group then trained RIOs for the operational squadrons. Some also gained experience in the rear seat of USAF F-89 Scorpion all-weather fighters, while others came from the limited numbers of US Marine Corps F3D Skyknight radar operators to fulfil what was essentially a new task for US Navy fighter aircrew.

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VF-114 traded its F3H Demons for F-4Bs in 1961 and subsequently became the first Pacific Fleet unit to deploy with the Phantom II. Here, BuNo 152241 is about to engage the arresting gear onboard *Kitty Hawk* at the end of a mission with outboard-mounted TERs of ordnance. The squadron's aardvark logo, borrowed from Johnny Hart's 'B C' comic strip at the request of squadron executive officer Cdr Roscoe 'Rocky' Trout and CO Cdr 'Hap' Chandler, is seen in its original small format (*McDonnell Douglas*)

The focus was on 'command interception', steering the pilot into a favourable position to launch Sparrows. There could be no preparation for some of the actual wartime tasks RIOs would face, such as advising the pilot on the accuracy of his bombing, or even unstrapping from the ejection seat to watch for MiG fighters in the F-4's rear blind spot. During a fight he could be the 'eyes out of cockpit' while the pilot focused on his 'heads down' interception systems. Inexperienced RIOs were often paired with established pilots (and vice versa) to speed the learning curve, and they were indoctrinated in navigation, communications and controlling an interception, leaving the pilot free to 'drive' the Phantom II. In close combat their primary role of setting up long-range radar missile launches was often impossible to fulfil, and their eyeball view of the situation was then of greater value.

Many pilots with self-sufficient, single-seat backgrounds were slow to accept any sort of advice from a back-seater, but they soon came to appreciate what a two-man team could do with the superior APQ-72 radar compared with the more primitive equipment in their previous Crusaders, Skyrays or Demons. Some pilots stated that having responsibility for a second crewmember made them a little more risk-averse in combat, particularly in 1966-67 when many RIOs were leaving the service early. Cdr (later Capt) Will Haff, CO of VF-154 in 1967, recalled;

‘My biggest concern was always the safety and responsibility I had for the RIO. I had always been accustomed to single-seaters where if I crashed and killed myself at least I didn’t carry the burden of doing the same to the RIO. A true fighter pilot is probably a bit reckless, and that may be the edge that makes him so good in dogfighting tactics.’

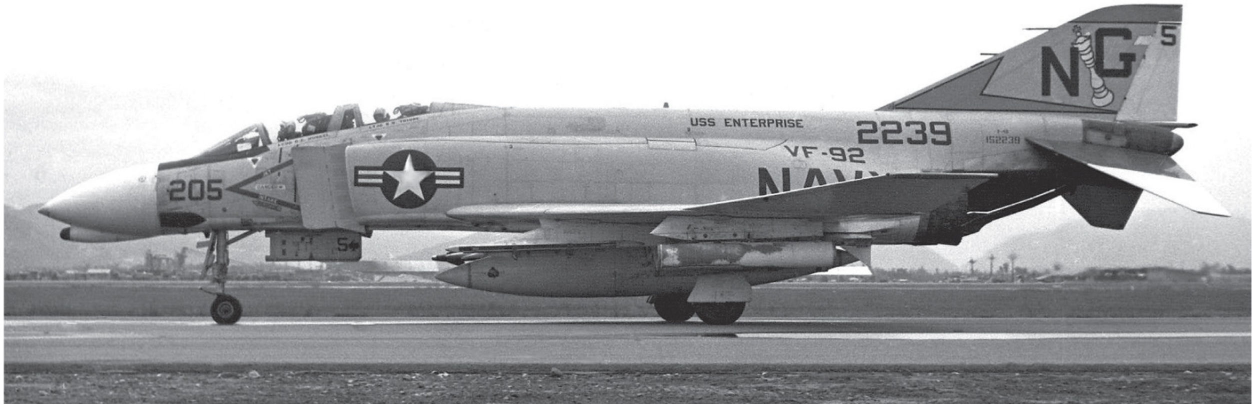
Pilots with single-seat experience had formed the core of the first two deployable F-4B units, VF-74 and VF-114, in 1961. Cdr Bill Knutson, who had flown single-seat types ranging from the F6F-5N Hellcat to the F8U-1 Crusader, was used to handling his own radar intercepts, but he initially ‘tolerated the RIOs and gave them lip service, but at crunch time in an interception or dogfight I did what I knew had to be done without listening or taking any direction from the RIO. On one intercept the RIO had locked onto the target, and I simply said, “I’ve got it” and proceeded to manoeuvre into position for a Sparrow shot. The RIO became furious. He turned off his radar and said, “See how good you are without me operating the radar.” Naturally, the radar could not be operated from the front cockpit. These problems smoothed out over the years and essentially went away when it came time for combat.’

The Vietnam War produced some outstanding examples of effective F-4 cockpit teamwork, and successful crews devised their empathetic routines for handling the work-load and the challenges, in addition to the rules for ‘division of labour’ specified in the F-4B aircrew manual.

The early experience of air combat in Vietnam re-emphasised the need for VF-101 Det A at Oceana and VF-121 to develop ground attack skills too. There was no syllabus for this until the Replacement Air Groups developed one between November 1964 and October 1965. For ground attack training VF-213, deploying aboard *Kitty Hawk* in October, relied on borrowed USAF MERs, TERs and weapons manuals, as well as the previous experience of senior squadron personnel who had flown Korean War bombing missions in A-1 Skyraiders and F9F Panthers.

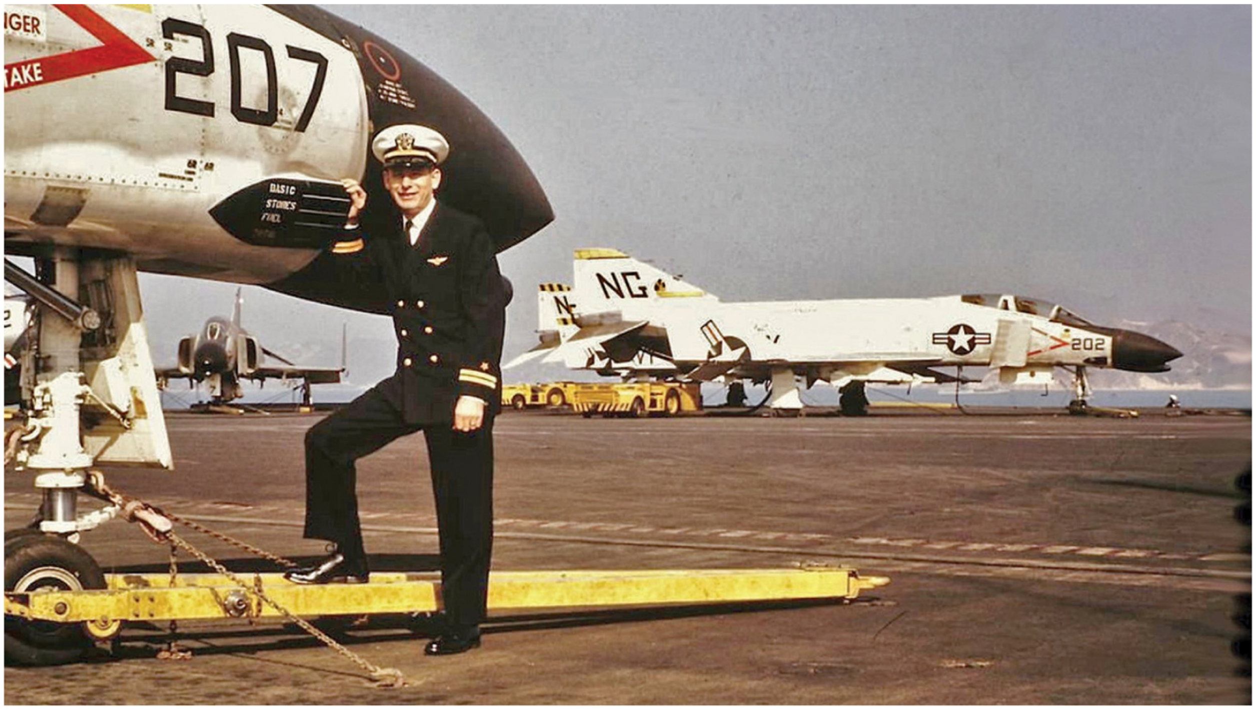
OPENING SHOTS

In May 1963 VF-96 ‘Fighting Falcons’, embarked in CVA-61, flew some of the earliest US Navy F-4 ‘show of strength’ missions off the Vietnamese coast together with the F-8C Crusaders of VF-91 during the Laotian crisis, but no intervention was required. The squadron had been designated VF-142 until 1 June 1962 when it became VF-96 so that its first number, in an old naval tradition, matched its carrier air group (CVG-9) and its partner squadron, VF-91. It was commanded by 'Head Falconer' Cdr Vincent P O'Rourke until 27 November 1962, but no RIOs arrived until 18 December – only nine were on strength when the squadron joined the air group shortly thereafter.



Making a fuel stop at Da Nang in 1966, 'Silver Kite 205' (F-4B-21-MC BuNo 152239) of VF-92 has a scorched, empty LAU-10 Zuni pod on its outboard pylon ordnance adapter. VF-92 was among the earliest F-4B units in action, deploying with VF-96 for 103 days on the line aboard *Ranger* from August 1964. BuNo 152239 suffered an engine fire as it was launched on a night strike mission from *Coral Sea* on 17 May 1970, the jet crashing into the sea just five seconds after leaving the flightdeck. It was serving with VF-161 at the time of its demise (*US Navy*)

By the time the unit deployed onboard *Ranger* again in August 1964 (by then CVG-9 had become CVW-9 and VF-91 had been replaced by F-4B-equipped VF-92), VF-96 had spent considerable effort at NAS Miramar practising air-to-ground ordnance delivery using newly acquired MERs and TERs. The unit's first combat mission was flown on 2 December 1964, providing an escort for RVAH-5 Vigilantes in Operation *Yankee Team* (low-altitude target reconnaissance flights over southern Laos), which had commenced in May. By June 1964 four CVWs were flying from aircraft carriers in the Western Pacific (Westpac) when, on the 6th, the US Navy sustained its first aerial loss – an RF-8A Crusader from VFP-63 Det C embarked in *Kitty Hawk*, shot down during a *Yankee Team* reconnaissance mission over Pathet Lao territory in Laos. Fighter escort then became mandatory for these missions, but a VF-111 'Old Nick' F-8D Crusader was lost on 7 June while escorting another RF-8A – the first of four similar Crusader losses that year.



Variations on VF-96's tiger-stripe markings in 1964, including a non-standard 'tiger tail' on Sidewinder-armed 'Showtime 202'. The stripes were believed to assist with formation flying in poor visibility. Lt Ron Beecher leans on 'Showtime 207's' cabin air intake, used as a chalk-board to indicate total aircraft weight to the deck launch crew, ensuring correct catapult settings (*Courtesy of the Beecher family via VetFriends*)

US Navy pilots entered direct conflict with North Vietnamese forces on 2 August when the Desoto intelligence-gathering destroyer USS *Maddox* (DD-731) came under attack by enemy P-4 patrol torpedo (PT) boats. *Maddox* received light damage, and at least one PT boat was sunk by 5-in gunfire and VF-51 F-8E Crusaders. *Constellation* joined the naval Task Force in response. A second attack on *Maddox* (and USS *Turner Joy* (DD-951)) allegedly occurred on 4 August, and this was the pretext for President Lyndon B Johnson to launch Operation *Pierce Arrow* from *Constellation* and USS *Ticonderoga* (CVA-14) against North Vietnam's PT boat base and an oil depot at Vinh on 5 August.

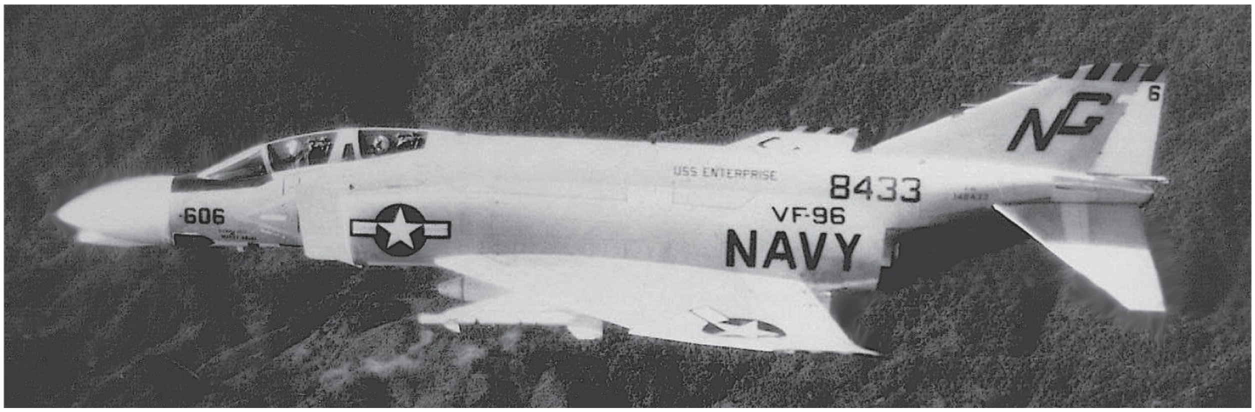
CVW-14's F-4Bs from VF-142 'Ghostriders' and VF-143 'Pukin' Dogs' escorted VA-52 and VA-145 A-1H/J Skyraiders and a force of A-4C/E Skyhawks from VA-144 and VA-146 that destroyed eight PT boats and left the oil facility in flames. The North Vietnamese were well prepared as President Johnson had given notice of this retaliatory strike. Two bombers were shot down as a result, including the A-1H of VA-145's Lt(jg) Richard Sather, who became first US Navy pilot to die during the war. A-4C pilot Lt(jg) Everett Alvarez of VA-144 ejected and duly became the first pilot to be captured by the North Vietnamese. The VPAF also moved its first

MiG-17 squadron, which had been training in China, to Noi Bai (Phuc Yen) air base, near Hanoi, the following day.

PT boats occasionally attempted further attacks. On 1 July 1966 three approached the radar control frigate *Coontz* and the destroyers USS *King* (DDG-41) and USS *Rogers* (DD-876), which were holding station offshore to coordinate search and rescue activities. They tried to close within torpedo range of the vessels, launching their weapons ineffectively at 12 miles. On this occasion F-4Bs from VF-151 and VF-161, embarked in *Constellation*, detected them and they were all sunk through a combination of Zuni rockets, bombs and 20 mm gunfire employed by aircraft from USS *Hancock* (CVA-19).

Undeterred by US reprisal attacks, Viet Cong guerrillas hit US facilities in Saigon and at Pleiku, triggering strikes by aircraft from *Coral Sea*, *Hancock* and the recently arrived *Ranger* on North Vietnamese barracks in Operation *Flaming Dart I* on 7 February 1965. Cdr Warren Sells, CO of CVW-21 (embarked in CVA-19), led the aerial armada. CVW-15 from *Coral Sea* launched 20 aircraft, including F-4Bs from VF-151 'Vigilantes' as MiGCAP and strike coordination elements. *Ranger*'s CVW-9 strike force of 34 aircraft had to abort its attacks because its Vit Thu Lu barracks target was blanketed by monsoon weather. The communist response was a provocative assault on a hotel used by US personnel in Qui Nhon, and this resulted in the Commander of Pacific Command, Adm Grant Sharp, securing presidential approval for his proposed escalation in the number of naval strikes being flown from carriers off North Vietnam.

Operation *Flaming Dart II*, involving *Ranger*, *Hancock* and *Coral Sea*, saw 99 strike and support aircraft hit barracks at Chanh Hoa on 11 February. VF-96 was tasked with flak suppression, and its CO, Cdr Bill Fraser, with RIO Lt(jg) Chris Billingsley, delivered the squadron's first wartime load of bombs against a AAA site. Lt(jg) Terry Murphy and Lt Giles Phillips were in Fraser's wingman F-4B. An A-4C and an F-8D from CVA-43 were lost, the Crusader (from VF-154) coming down during a flak suppression attack after it possibly ingested debris from its own rockets. Lt Cdr Robert Shumaker ejected into captivity, becoming the second US Navy aviator to become a PoW.

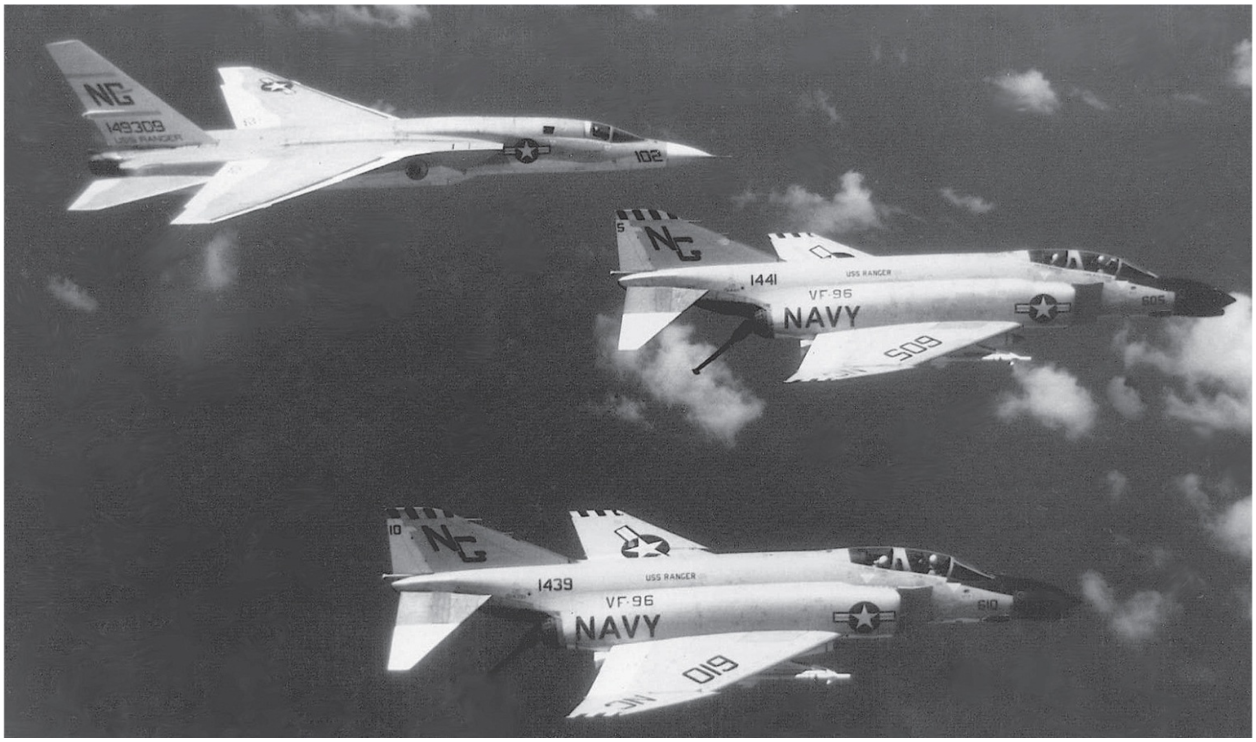


The initiation of Operation *Barrel Roll* in December 1964 involved VF-96 in covert close air support missions for the Royal Lao Armed Forces and some of the early interdiction bombing and escort flights over the Ho Chi Minh trails complex in Laos. BuNo 148433, an early Block 8 F4H-1 (F-4B), wears the squadron's black and yellow/gold tiger stripes and an 'escort' weapons load as it cruises over typically inhospitable Laotian territory during the nuclear-powered *Enterprise*'s first combat deployment in 1965-66. Passed on to VF-154 at the end of the cruise, this aeroplane was hit by AAA during an attack on vehicles south of Vinh on 3 November 1966. The jet caught fire as its crew headed out to sea, and it was eventually abandoned by Lt R W Schaffer and Lt(jg) J P Piccoli (*R Lawson/US Navy*)

Two days later, frustrated by North Vietnam's refusal to back down or negotiate, but convinced that its leaders would soon respond to increasing US military pressure, President Johnson initiated the *Rolling Thunder* programme of sustained bombing that turned the previous retaliatory strikes into a fully developed air war from 2 March. TF 77 aircraft joined the campaign on 15 March with a strike by *Ranger*'s CVW-9 on a Phu Qui ammunition dump, followed by a bigger assault mounted from *Coral Sea* and *Hancock* 11 days later. Having suffered a broken fuel line, which filled its main machinery room with flames on 13 April, *Ranger* headed to Subic Bay, in the Philippines, for temporary repairs and then sailed home to Alameda, California, in early May. The vessel would return to combat on 10 December with CVW-14 (including VF-142 and VF-143) embarked for the first attacks on Haiphong.

OPERATION *BARREL ROLL*

From 2 December 1964 US air strikes were authorised against North Vietnamese infiltration routes through Laos as the first stage in a plan that would take the attacks steadily closer to North Vietnam's heartland in the hope of persuading the country's leaders to stop promoting Viet Cong activity in South Vietnam. Codenamed Operation *Barrel Roll*, the strikes began on 14 December and occupied much of the carrier air wings' time for the following three months. CVW-9 mounted an armed reconnaissance mission on 17 December against a bridge at Ban Boung Bau, using four VA-95 A-1Hs with an escort of eight F-4Bs from VF-96 ‘Fighting Falcons’. That same month VF-142 and VF-143 were cleared to fly *Yankee Team* escort missions over Laos, replacing VF-211’s F-8Es from CVA-19. Escort sorties for pre-strike reconnaissance flights by RA-5Cs of RVAH-5 over Laos were added from 3 March 1965 in Operation *Blue Tree*.



VF-96 F-4Bs accompany an RVAH-5 Vigilante on an early *Rolling Thunder* mission from *Ranger* in 1965. Vigilante aviators relied on speed to survive, approaching their photo-targets at around Mach 1.2 and 3500-5000 ft after the smoke and dust of the strike had subsided (*US Navy*)

Most RA-5C losses were caused by AAA and small-arms fire, so F-4 escort crews tried to give timely alerts concerning gun locations. Flying alongside the reconnaissance aircraft at about a mile distance, the Phantom IIs were disadvantaged despite having the same engines as the bigger, heavier RA-5C since their aircraft were impeded by the drag of tanks and external missiles, unlike the ‘clean’ Vigilantes. The latter also carried about twice the F-4’s internal fuel load. Vigilantes crossed the coast in afterburner to reduce the smoke trail from their J79 engines, but even minimum afterburner generated speeds up to Mach 1.5, giving a Phantom II crew a hard time keeping up. From 3 March those missions were extended to areas within North Vietnam.

A VF-151 F-4B shows signs of wear after a long combat cruise onboard CVA-43 in 1964-65. The jet's lack of a Modex side-number suggests an imminent change of identity or transfer to another location. The 'peacetime' orange flight suits worn by the pilot and RIO were useful when it came to spotting downed aircrew at sea, but they were soon exchanged for low-visibility kit once the *Rolling Thunder* attacks gathered momentum. However, aircrew generally preferred to keep their distinctive squadron-marked flying helmets (*Don J Willis*)

The first US Navy strike of *Rolling Thunder* took place on 18 March, ahead of the first weekly 'package' of attacks authorised within *Rolling Thunder 7* from 19 to 25 March. Armed reconnaissance of a limited number of roads and railway lines was permitted, and at the insistence of Adm Sharp (in charge of naval forces in the Pacific from 1964 to 1968) attacks on nine coastal early warning radar sites were also allowed. Sharp would have preferred a more direct and sustained assault on North Vietnam's military strength than President Johnson deemed appropriate. Even so, the destruction of the radar site on the island of Bach Long Vi, 70 miles offshore from Haiphong, severely damaged one of the sites that closely monitored TF 77 activity and gave early warning of incoming strike forces.

This 26 March 1965 attack by 70 aircraft resulted in two from *Hancock* and one from *Coral Sea* (making its first of seven war cruises) being shot down, although all pilots survived. Three more (two flown by squadron commanders) from CVA-43 were lost to AAA during a re-attack by a similar force on 29 March. F-4Bs from VF-151 flew top cover for both strikes. The 'Vigilantes' completed almost 1500 combat sorties on this, their first of six TF 77 cruises. The constant emphasis on reattacking targets until they were deemed by ‘desk pilots’ in Washington, D.C. to be totally destroyed was a major cause of US air losses during the war. North Vietnamese defences were often reinforced at a target site after an initial attack in the sure knowledge that the Americans would return shortly afterwards.

In April 1965 US Navy aircraft flew around a half of the 1500 sorties sanctioned over North Vietnam below the 20th parallel. Most concentrated on targeting transport routes to South Vietnam, and many aeroplanes flew armed reconnaissance sorties in the hope of catching troops or vehicles at vulnerable points on the trails network. One major supply route was the railway from Vinh at the lower edge of RP 3 southwards through the demilitarised zone (DMZ) into South Vietnam. Two large bridges on this line at Dong Thuong and Thanh Hoa became priority targets in April. The former was badly damaged in a 3 April attack that also provoked the first intervention by VPAF fighters. Two flights of MiG-17s intercepted flak suppression F-8s from *Hancock* and damaged Lt Cdr Spence Thomas’s VF-211 jet, forcing him to divert to Da Nang AB with hydraulic damage, although VPAF pilot Pham Ngoc Lan claimed it as the first VPAF kill. Four VF-151 F-4Bs provided TARCAP but the MiGs made their hit-andrun attack before the Phantom IIs could intervene.

NG
USS RANGER
1438
VF-96
NAVY
601

‘Showtime 601’ (BuNo 151438) was assigned to New Yorker Lt(jg) Terry Murphy, although he flew BuNo 151403 at the time of his fateful engagement with communist Chinese Shenyang J-5 (MiG-17F) fighters on 9 April 1965. Murphy had flown as wingman to the squadron CO, Cdr Bill Fraser, on the first VF-96 combat mission during Operation *Flaming Dart* in February 1965. This F-4B was also lost in 1965 after it ran out of fuel in very poor weather while attempting to land on *Enterprise* on 28 December – the carrier’s eighth loss in its first month of combat operations (*Author’s collection*)

The massive 540-ft-span Ham Rong (Dragon’s Jaw) bridge at Thanh Hoa, re-built in 1964, absorbed many assaults by US Navy and USAF aircraft over the following years and numerous losses resulted. Its destruction became a US Navy responsibility within RP 4 when the Route Package system was introduced in April 1966.

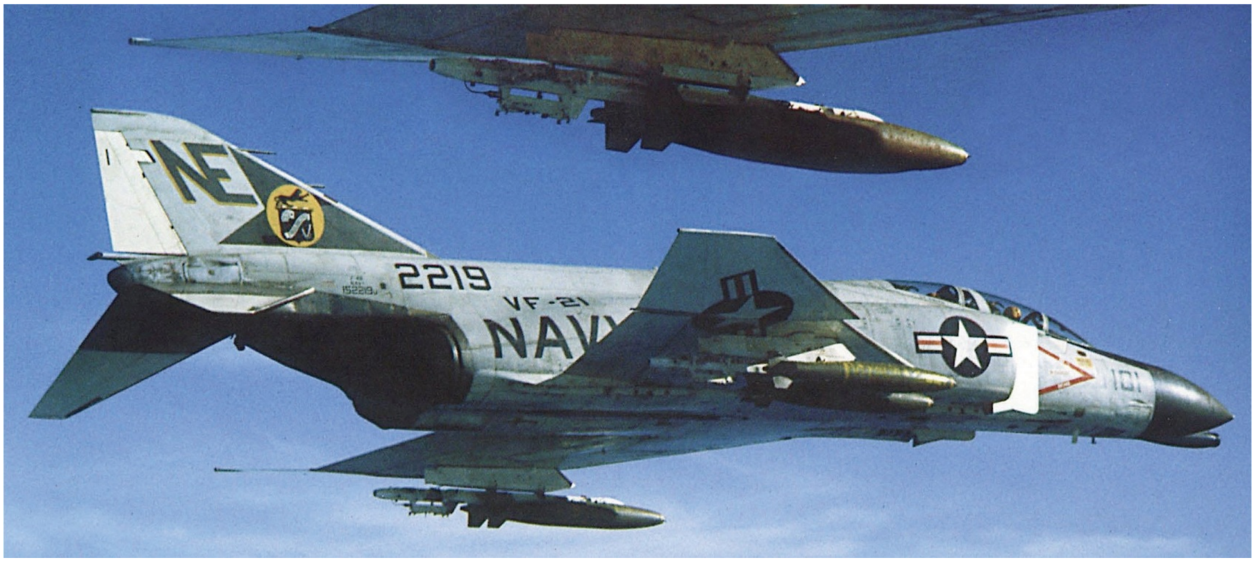
THE OPPOSITION – MiGs

On 9 April 1965 a flight of four VF-96 F-4Bs from *Ranger* flew a BARCAP for a *Rolling Thunder* attack near Haiphong in the hope that they could entice VPAF MiGs into another engagement. As on 11 February, the lead F-4B was crewed by Cdr Fraser and Lt(jg) Billingsley, with Lt Don Watkins and his RIO Lt(jg) Charles Hayes as their wingmen. A second section of two jets was led by Lt(jg) Terry Murphy and recently qualified Ens Ronald Fegan. The latter crew had originally been scheduled as Fraser's wingmen once again. However, they had had to replace Lt Cdr Bill Greer and Lt(jg) Richard Bruning, whose F-4B (BuNo 151425) had suffered an engine failure on launch, forcing them to eject fractions of a second before the aeroplane hit the sea. As Bill Greer told the author, 'I recall looking face down at the water, followed by a hefty jolt as the parachute opened and snapped my feet forward. I hit the water on my back before I could enter a vertical descent.'

Murphy, whose jet was armed with four AIM-7Ds (while the other aircraft carried two AIM-7Ds and two AIM-9Bs), linked up with an F-4B flown by Lt Howie Watkins and Lt(jg) Jack Mueller and headed for Fraser's section of their 'Showtime' BARCAP flight. Trailing their CO's jet by 20 minutes, they had to fly as a separate pair, 50 miles from the leader's F-4, rather than using the same radio frequency and controller as Fraser's aircraft. As they skirted Chinese-occupied Hainan Island, four highly polished silver Chinese J-5 (MiG-17F) fighters appeared above them. When Watkins and Mueller dived away in afterburner to avoid interception, they became separated from Murphy.

A confused supersonic melee ensued in which the Chinese pilots later claimed that they did not engage the Phantom IIs and their US Navy counterparts reported that Murphy's aircraft was pursued by J-5s (which they assumed were North Vietnamese). The F-4Bs then turned to engage the intruders at around 40,000 ft, awaiting clearance from *Ranger* to fire. The four Phantom IIs had by now lost flight integrity in a situation that one of the crewmen later described as 'unmitigated chaos and mayhem'. Lt Don Watkins and his RIO Lt(jg) Charles Hayes (in 'Showtime 610') fired an AIM-7 at one J-5 in ideal interception conditions but the weapon's motor did not ignite. Watkins followed with AIM-9Bs, but one stayed on the rail, then with another AIM-7D. Fraser, in 'Showtime 603', attempted a

Sparrow firing at another J-5 but it also refused to launch and the Chinese pilot then outmanoeuvred a follow-up Sidewinder from 'Showtime 610'. Watkins was surprised at how well the MiG could turn.



F-4B-21-MC BuNo 152219 was crewed by Lt 'Jack' Batson and Lt Cdr Robert Doremus on their MiG-killing flight on 17 June 1965. Here, it is loaded with four Mk 83 1000-lb bombs on its outboard MERs but, unusually, no centreline fuel tank. The requirement to make a visual identification of a potential target using the standard interception tactic meant that one aircraft (from a MiGCAP pair) had to accelerate ahead, often exceeding the speed at which the big centreline tank could be safely jettisoned, prior to the start of an engagement. As Cdr Lou Page observed in 1967, 'One cannot afford to jettison tanks every time there is a radar contact because such contacts are frequent and have to be investigated'. In several dogfights – the high-energy 6 October 1965 encounter in which Lt Cdr Dan Macintyre and Lt(jg) Allen Johnson scored a 'probable' kill for example – the tanks were retained because the F-4Bs concerned had already accelerated past the safe jettison speed. The tanks were, in any case, often in short supply, and many pilots felt that their 250-lb empty weight was manageable (*US Navy*)

Howie Watkins and Mueller tussled with several J-5s as the fight drifted ever closer to Hainan, but they did not fire any missiles. Murphy is thought to have launched an AIM-7 during a vertical attack, and both Hayes and Fraser attempted further AIM-7 launches but both missiles failed. At that point Murphy's F-4B (BuNo 151403 'Showtime 611') was apparently hit by a missile from one of the Phantom IIs, according to the Chinese flight leader who stated that the F-4B crashed just offshore from Hainan Island with its crew still aboard. No trace of them was ever found, and the loss was officially attributed to a MiG or to fuel starvation. Mueller glimpsed an aircraft falling in flames but assumed it was one of the J-5s, hit by an F-4's missile. The remaining three Phantom IIs withdrew, low on fuel, and caught an A-3B tanker that was diverted from a *Rolling Thunder* assignment. They had come through an 18-minute engagement during which the Chinese pilots stated that they never received clearance to fire their guns.

Murphy and Fegan received unofficial credit for the supposed 'MiG kill' that Mueller observed (all four J-5s reportedly returned to base), but the realisation that the MiGs were probably Chinese triggered severe diplomatic complications and the event was 'buried' by the White House. More importantly perhaps, the 9 April conflict was an early demonstration of the difficulty in using the F-4's all-missile armament in a fight of that kind. Eleven missiles were launched and all failed to perform as expected. In the case of the AIM-7Ds, it was established that faulty launch switches had separated the missiles' electrical 'umbilical cords' before firing their motors.

NE
1485
VF-21
NAVY
108
USS MIDWAY
NE
2219
VF-21
NAVY
102

MiG-killer BuNo 152219 (now 'Sundown 102') and BuNo 151485 are seen here with yet another ordnance variation – eight Mk 80-series GP bombs on outboard MERs. Both the US Navy and the VPAF often flew two aircraft very close together inbound to the target in an attempt to fool enemy radar into thinking that there was only a single 'plot' (*US Navy*)

During the next, inconclusive, engagement by VF-21 'Freelancers' on 4 June, which saw F-4Bs from *Midway* (the carrier whose aircraft would score the first and last MiG kills of the war) tangle with four VPAF MiG-17s, another AIM-7D that had tuned up well on deck did not trigger the pilot's 'ready' (to launch) light and remained in its well. Pilots were subsequently told to keep their fire-control system's AN/APA-157 constant-wave illuminator set to 'on' rather than 'standby' to show which missiles were up and ready. The MiGs fired unguided, inaccurate air-to-air rockets at the 'Freelancer' aeroplanes.

The first combat mission flown by VF-21's Lt David Batson saw him looking for evidence of Murphy and Fegan's aircraft. The identity of the MiGs involved in the conflict was not a priority at the time. Although it was known that communist China would defend airspace within 30 miles of its borders, and that its fighters had already shot down other US Navy aircraft, it was believed that the MiGs engaged by VF-96 could well have come from North Vietnam. En route to the conflict Lt Batson and his fellow CVW-9 aviators had been told by their Air Boss, Cdr Bob Moore, that 'We could not attack a MiG unless he showed hostile intentions'.

However, ‘any MiGs that we saw were hostile. Shoot them down’.

Batson’s own MiG engagement on 17 June was very different, employing careful tactical planning and enabling the F-4B’s weapon system to be used in near-optimal conditions. He and his RIO, Lt Cdr Rob Doremus, were ‘Sundown 102’ in a six-aircraft BARCAP led by VF-21’s Korean War veteran executive officer Cdr Louis Page (with 4000 hours in fighters) and his expert RIO, Lt J C Smith. The squadron had undergone some hard pre-deployment training, during which Smith had developed a technique for visually identifying an oncoming enemy without having to wait until it came too close for a Sparrow’s minimum launch range. His ‘VID manoeuvre’ required the Phantom IIs to fly a course that was slightly offset from the original head-on approach. This made the ‘bogie’ MiGs turn slightly towards the F-4s and bank, revealing their silhouettes for a better visual identification.

Page also devised the ‘run out manoeuvre’ in which one Phantom II flew close to the MiG, head-on for a VID, and then initiated a maximum power, 7g turn of 210 degrees at around 11 miles separation. If the MiG attempted to follow this turn he would find himself at the F-4’s ‘12 o’clock’ position and in range for a Sparrow shot.

Page and Batson flew at the landward side of the BARCAP orbit, monitoring the MiG bases at Noi Bai and Kep as the strike force went in to bomb. After 30 minutes the bombers announced that they were leaving the target to go ‘feet wet’ over the coast, releasing the BARCAP from its duties. Smith, although down to 7000 lbs of fuel (only 1200 lbs above the ‘bingo’ level), persuaded Page to make one last orbit as he carefully scanned his APQ-72 radar image of Noi Bai (Phuc Yen). He quickly spotted two contacts approaching them separately, head-on at about 32 and 35 miles’ range respectively. Smith surmised that the MiG pilots were being vectored onto the BARCAP Phantom IIs’ tails as they left the target area.

Cdr Lou Page with a symbol on his F-4B's flank marking the first US Navy MiG kill of the war. After Cdr Bill Franke's shoot-down by a SAM on 24 August 1965 Lou Page took over command of VF-21, and with J C Smith, his long-standing RIO, he subsequently became a major contributor to the US Navy's Topgun programme (*US Navy*)

Using a plan that they had discussed before the mission, Batson dropped back into a three-mile in trail position. Page would go forward to VID the leading MiG and Batson would be the 'shooter' at that MiG, as his aircraft would be in position to give the AIM-7D the two miles of separation from the target that it needed to guide correctly. Page could then fire at the second MiG, three miles behind the leaders. This 'looker-shooter' tactic – a variation on the standard interception manoeuvre – was not universally approved. VF-143's executive officer, Cdr M W Townsend, favoured a one-mile 'loose deuce' spread formation instead, with two Phantom IIs flying abreast. His approach became accepted more generally. He also advocated a Crusader-type re-attack from any appropriate direction after the run-through for the first head-on launch, rather than a predictable dive and return for a second missile launch from the rear.

The ‘Sundown’ F-4Bs made visual identification at four miles’ range, using Smith’s ‘ident Sparrow’ or ‘VID manoeuvre’ to make the enemy bank slightly, revealing that each contact was actually a pair of MiGs flying close together. Both Phantom IIs had already locked their radars on to the targets. David Batson recalled what happened next;

‘Lou fired at close to minimum range while shouting “It’s MiGs!” I saw his missile fire, guide towards the formation and detonate. At first I thought it had missed but then the outer half of the right wing came completely off a MiG and it started rolling out of control. I then put my full attention to the steering information on my radar scope and I fired at minimum range. Just before firing, the steering dot moved up the screen, causing me to go into a slight climb to keep it centred. The AIM-7D fired from the rail on the right wing and swerved under the nose of the airplane. I lost sight of the missile but Rob saw it guide to a direct hit. The next phase of Lou’s tactics was for us to disengage quickly. He was very concerned about trying to turn with a MiG-17 or MiG-19. Then we reversed heading and went back through the clouds, looking for the rest of the MiGs. We saw smoke trails from our missiles, but no MiGs and one parachute.’

In fact, debris from Batson’s target aircraft also brought down the MiG pilot’s wingman, flying in close formation only 200 ft above Page’s F-4B. Batson and Doremus were belatedly awarded a second kill in 1997.

The first US Navy MiG killers, Lt David Batson, Cdr Louis Page, Lt Cdr Robert B Doremus and Lt John C Smith Jr, are debriefed after their MiG encounters. Dave Batson confided that 'Someone handed me a coffee cup. It was full of scotch! We were taken to Air Intelligence (I still had my "coffee cup"), where we told the Admiral what had happened' (*US Navy*)

This first practical demonstration of the validity of the Phantom II's head-on Sparrow-launching interception capability was to be a rarity during the conflict in which the other ten confirmed kills by F-4 crews up to July 1968 were mostly achieved in far less 'textbook' circumstances. Five months elapsed before a US Navy Phantom II was involved in another successful MiG engagement.

On 6 October 1965 former F-8 pilot Lt Cdr Dan Macintyre and RIO Lt(jg) Allen Johnson from VF-151 were assigned as BARCAP with section leader Lt Cdr Tom Ewall for a strike on the Vu Chua bridge near Kep air base during *Coral Sea*'s sixth and final line period of its first war cruise. They detected a contact approaching at 18 miles that was soon displayed as a three-aircraft formation on their radar, rather than the returning F-4 CAP flight from their partner squadron, VF-154, which they at first assumed was heading their way. Macintyre used a similar tactic to Lou Page's on 17 June, dropping back to give a more favourable separation for a Sparrow launch within correct parameters. At three miles the 'bogies' were visible as silver MiG-17s, crossing in front of them towards their left side. At 4000 ft Macintyre engaged afterburner and fired an AIM-7D at 3000 ft. It exploded ten feet from the second MiG, probably inflicting fatal damage.

He then passed deliberately close to the third MiG, which dived away towards Phuc Yen with Macintyre in pursuit, closing rapidly. His wingman, Lt Cdr Tom Ewall, had by then manoeuvred to engage the lead MiG-17 but had misjudged a turn, allowing the VPAF jet to move into a gun-firing position behind him at an altitude of only 500 ft. Macintyre broke off from his almost certain second kill and rolled in behind Ewall's opponent, which began to fire repeatedly, but inaccurately, at Ewall's F-4B as it turned, losing energy. Although the MiG-17 was heavily armed with 23 mm and 37 mm cannon, vibration, poor visibility from the cockpit and inefficient flight controls made gun-aiming through its primitive gunsight difficult, particularly at low altitude.

With the F-4B flying so close to the terrain, it was impossible for the jet's weapons system to acquire a missile lock-on due to radar returns from the ground. Macintyre's turn was also too steep for an AIM-9B to cope with, and the missile would probably have been unable to distinguish the MiG's heat signature in any case. Luckily, the MiG pilot decided to abandon his pursuit and headed away at treetop altitude. Without an in-built gun Macintyre had to let him go.

Although Macintyre's initial Sparrow shot had been as 'textbook' as Page's, the ensuing scrap revealed the shortcomings of the F-4's armament for close-in, traditional aerial combat at low altitude. Like the earlier engagement involving Murphy and Fegan of VF-96, the fight was not publicly acknowledged for some years as it was thought that the MiGs were probably Chinese. However, it was in due course possible to award the F-4 crew a confirmed kill – the last of 1965.

The first success for the VPAF's Sidewinder-copy R-3S 'Atoll' missile against US Navy F-4s came on 19 November 1967 when a VF-151 TARCAP section was jumped by four MiG-17s (flying from Kien An forward air base) and two MiG-21s while escorting A-4s from *Intrepid* off the target – airfields and bridges near Haiphong. F-4B 'Switchbox 110' (BuNo 150997, which had previously been loaned to the USAF as an 'F-110A' trainer), flown by Lt Cdr Doug Clower and Lt(jg) Walt Estes, was hit by a missile that severed its right wing. The jet's destruction was claimed by 923rd Fighter Regiment (FR) ace Le Hai. Wingmen Lt(jg) s James Teague and Ted Stier were also hit by cannon fire or debris from

Clower’s exploding Phantom II. Clower and Stier (on his 155th mission) became PoWs, but Estes and Teague were both killed. It was perhaps some consolation that theirs were the only US Navy F-4s lost to MiGs in 1967, while six VPAF fighters were in turn shot down by Phantom II crews. Ten, however, were claimed by Crusader pilots in the second half of that year.

For the majority of F-4 crews a MiG encounter or even a sighting of VPAF fighters was a rarity, but as Capt ‘Whip’ Ault, commanding *Coral Sea*, noted, losses in aerial combat rose from three per cent of overall combat losses in 1965 to 23 per cent by 1968. The threat was persistent, despite periods such as the winter of 1967 when US fighter pilots clearly had the advantage. To many pilots the obvious solution from the outset was to demolish the VPAF’s bases near Hanoi. Naval squadrons were not allowed to hit the most desired target, Kep airfield, until 24 April 1967, three years after first seeking permission to do so. At the time the VPAF fighter threat was low partly because the MiG-21 squadron (921st FR) had been severely depleted by the USAF’s Operation *Bolo* on 2 January 1967, with a total of 16 MiG-21s destroyed by 26 April. However, MiG-17s were still active, particularly in the Route Packs managed by the US Navy, and the airfield defences were prodigious.

FREELANCERS
F-4B
NAVY

Former F3H-2M Demon pilot Cdr F A W 'Bill' Franke, CO of VF-21 from November 1964, spent 2730 days as a PoW in Hanoi after he and his RIO, Lt Cdr Rob Doremus, became the first US Navy officers to survive a hit by an SA-2 on 24 August 1965. His MiGCAP F-4B (BuNo 152215) was struck at 11,000 ft, the jet losing most of its left wing. After his release, Cdr Franke became commander of VX-4, developing new fighter tactics. Rob Doremus was a MiG killer with Lt David 'Jack' Batson during the first successful MiG engagement by US Navy Phantom IIs (*US Navy*)

VPAF tactics continued to evolve in 1967, with MiG-21s generally making supersonic hit-and-run passes at a strike package from above, or sometimes in a steep climb from lower altitude, where they had been hiding from radar coverage. MiG-17s made their attacks from low altitude and developed a 'wagon wheel' orbiting formation while awaiting the opportunity to attack. The 'wheel' enabled each MiG to protect the tail of the fighter in front of it as the circus revolved. Later, bold F-4 pilots would learn to drop into the wheel and hit MiGs.

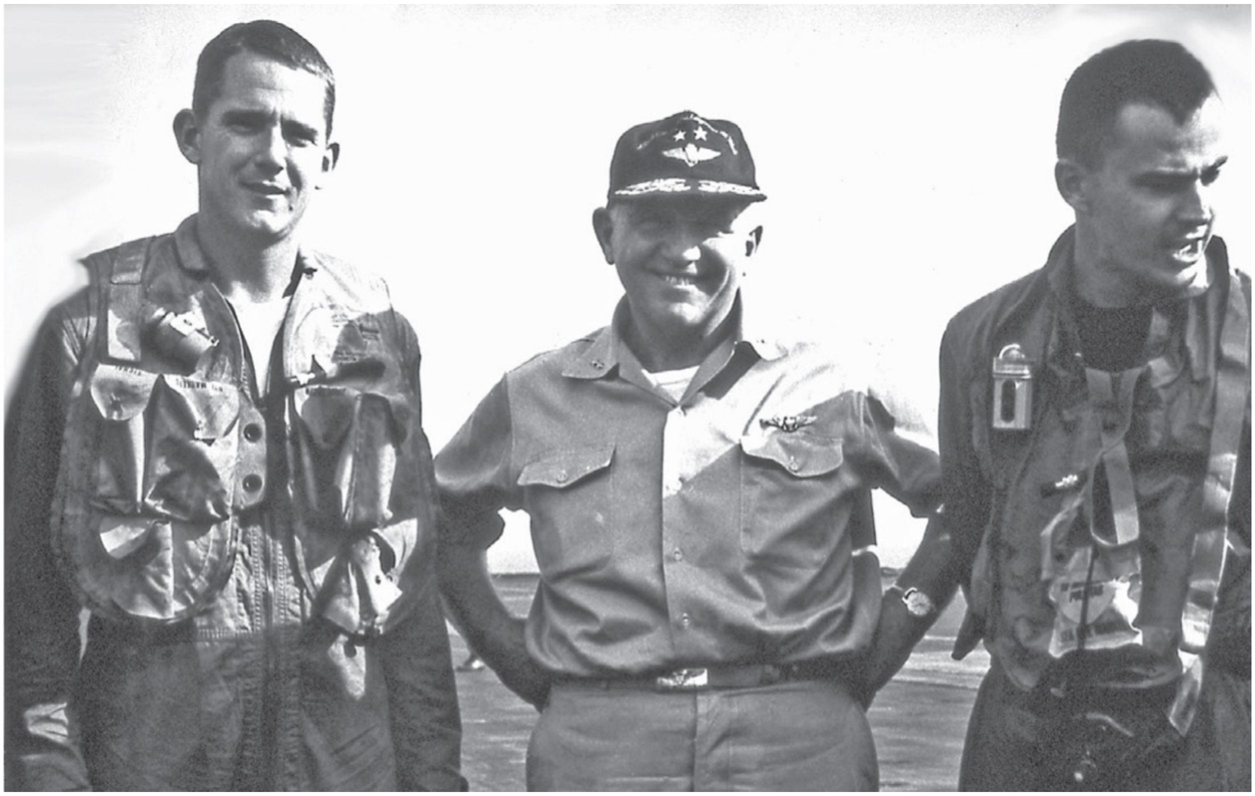
The threat from Chinese MiGs also persisted, and on 13 August 1967 a VF-142 reconnaissance escort for a *Blue Tree* RA-5C from RVAH-12 was attacked by up to six MiG-19s as they passed within seven miles of the Chinese border. Several 'Atolls' and a lot of 30 mm gunfire were directed at the 'Dakota' F-4Bs, which managed to escape into cloud. Chinese MiG-19s struck again eight days later, destroying two A-

6A Intruders from VA-196 that had accidentally crossed the border in stormy conditions after attacking the Duc Noi railway marshalling yard – three Naval Aviators were killed and one captured. The unit had had its CO shot down over the target area by a SAM earlier in the mission.

THE OPPOSITION – GROUND DEFENCES

Sadly, Rob Doremus joined the list of victims of the Than Hoa bridge on a 24 August 1965 MiGCAP mission when he and the squadron CO, Cdr Frederick 'Bill' Franke, became the first US Navy officers to survive being shot down by an SA-2. SAMs were responsible for 18 US Navy and US Marine Corps F-4 losses during the war, and 52 Phantom II losses overall, including USAF jets – one more than the total of F-4 losses attributed to MiGs. In addition to the losses caused directly, SAMs often drove strike aircraft down into AAA at lower altitudes, and in many cases they forced the jets to jettison their ordnance and escape, negating the purpose of their missions.

SAMs and AAA batteries were closely coordinated with MiG activity to provide a tightly organised, radar-directed defence network. However, it was AAA that caused the majority of the total of 758 F-4 losses, together with small-arms fire at lower altitudes virtually anywhere in the country. Some squadrons advocated crossing the beach as low as possible to avoid radar, attempting to pass the small-arms gunners at high Mach before they could draw a bead.



Lt Grover Erickson (left) and Lt(jg) John Perry were photographed with Rear Admiral J R Reedy, Commander of TF 77 (centre), after being hauled out of the sea by a UH-2A helicopter and SAR ships on 26 October 1965. Grover activated the 'eject' warning light for his RIO when he saw flames emerging from the port air intake of their F-4B after it took two hits during a midnight strike on patrol boats operating from Bac Long Vi Island off Haiphong (*US Navy via Cdr G Erickson*)

SAMs forced the fleet's KA-3B tanker aircraft to remain at least 20 miles offshore, leading to some tense moments for fuel-starved Phantom II crews. They were also particularly hazardous to aircraft flying above a cloud base. They could disrupt strike forces in other ways too by forcing aircraft to fly lower in the hope that the missiles would not have time to track them. Lt Grover Erickson, flying F-4Bs with VF-84 'Jolly Rogers' from *Independence* in 1965, recalled, 'As scary as it was at first, we never did lose any airplanes during the actual strike. We did lose two planes en route to the target when a SAM alert caused the strike group to go in at an altitude where the flak could get them'. Ken Baldry recalled the effects of flak during a 1967 strike on Kep airfield;

'There was plenty of flak of all calibres in the target area, but since we were a very fast-moving strike group it didn't appear that much of it was very well aimed – mostly barrage fire. It was heavy enough that I lost sight of the F-4 ahead of me and only regained sight of him when we went "feet wet". I let my bombs go at a string of revetments at the eastern end of the runway but didn't have time to look back and see what the effect was as we were jinking to avoid flak and heading out over water as fast as we could go.'

VF-84
NAVY
USS INDEPENDENCE
1478
AG

VF-84 F-4B-19-MC BuNo 151478 thunders away from the waist catapult of *Independence*. Laden with Mk 83 bombs, AIM-7Ds and AIM-9Bs, '211' is heading out on an October 1965 *Rolling Thunder* mission. This aircraft was shot down near An Hoa, just 15 miles from Da Nang, on 7 June 1970 whilst assigned to VMFA-122 (*McDonnell Douglas*)

Lt Erickson's F-4B (BuNo 151505) was hit on the night of 26 October 1965 during one of the regular attacks on the Bach Long Vi radar site and nearby PT boat base. As he pulled up after firing his four LAU-3/A rocket pods in a 25-degree dive he felt two hits and then heard a dull explosion somewhere in the aircraft;

'I lost complete control of the rudder. I had the distinct impression that the landing gear extended, then retracted. At this time the fire warning light on the starboard engine illuminated and I secured the engine. The cockpit then filled with smoke and we had a complete electrical failure. As the cockpit became dark I noticed flames coming from the port intake. I pushed the battery-powered "eject" light, heard my RIO [Lt(jg) John Perry] eject, and ejected myself.'

Both men were rescued by naval forces offshore.

Although most AAA was visually directed and often inaccurate, the sheer quantity made it the principal hazard, and crews had to determine suitable tactics to reduce their chances of being hit. In a two-aircraft section pilots tended to bomb individually when attacking smaller targets. This enabled the second F-4B crew to watch for ground fire and warn the crew making the bomb-run. Aircraft were usually at their most vulnerable as they pulled up from a target. Pilots also preferred to attack from different headings to complicate the gunners' firing solutions, dropping bombs in ripple mode or as pairs in quick succession. Minimum altitudes to avoid the lighter AAA weapons were around 3500 ft and speed had to be maintained throughout the attack run.

Above all, pilots were advised not to make more than one run at a target, although circumstances often made repeated attacks necessary, thereby giving the gunners several chances to calculate their firing accurately. 'Jinking' the aircraft with frequent small control inputs could also spoil the gunners' aim, and crews were told to remain above 3500 ft and keep jinking until they had crossed the coast at around 250 knots en route to the carrier.

Sometimes quite basic precautions could deny the AAA batteries their easier opportunities. In 1966 CVW-9 aircrew were told to avoid dive-bombing through small gaps in the cloud cover that frequently blanketed the target. While those openings were often the only way of seeing the target, they were also 'sucker holes' where the gunners would pre-aim their weapons, knowing that aircraft would probably appear through them. Similarly, pilots were advised to break their usual habit of turning to the left when pulling up off target. A turn in the other direction could also defeat pre-aimed AAA. The apparent mobility of most AAA resources was another problem. As a January 1966 TF 77 report noted, 'One day, in a heavily defended area, the sky was black with flak and the next day in the same location there was no reaction at all. This suggested, as one pilot put it, "that the enemy just wanted us to think he had gone somewhere else and hoped we would pass over tomorrow with a larger force"'.

AB
2318
VF-14
NAVY
107
AB
1021
VF-14
NAVY
102

These two VF-14 'Tophatters' F-4Bs are at about 800 ft, with armament switches off, tailhooks lowered and autopilot disengaged, ready to extend their landing gear and turn in to the downwind leg of the landing approach to CVA-42. Darkness or bad weather obviously made the recovery procedure far more challenging. Single F-4s often had to fly weather reconnaissance missions over the target area ahead of a strike. This required careful coordination with the advancing CAP F-4s to avoid 'blue-on-blue' situations, but there were several near misses, including an incident on 26 July 1967 when a weather reconnaissance crew from VF-143 were almost shot down by squadronmates after being misidentified as a MiG-21 by US radar controllers. Fortunately, a malfunctioning AIM-7 saved the day (*US Navy*)

Duelling with AAA batteries as a flak suppression flight was clearly the riskiest way of tackling the threat. As Rear Admiral John ‘Smoke’ Wilson, VF-14’s operations officer in 1966, put it, ‘to kill a flak site required the suppressor to fly down the gun barrel’.

On 14 May 1967 VF-114’s Lt Cdr Charles ‘Ev’ Southwick and his RIO Lt Jack Rollins were among the brave victims of the extraordinarily heavy AAA defences around the Ham Rong bridge at Thanh Hoa – a major and often-visited target and an iconic structure to the North Vietnamese. It survived numerous attacks including three direct hits by AGM-62A Bullpup guided bombs. Southwick had been an F-8 pilot onboard *Ticonderoga* during the *Pierce Arrow* attacks in 1964. He and his RIO Ens Jim Laing had been hit during the Kep airfield attack on 24 April 1967 as he escorted the CVW-11 strike force off target and back to CVA-63. Having avoided a sky full of SAMs, the US Navy jets were then approached by two flights of silver MiG-17s, and Southwick’s TARCAP flight turned to meet them. Three of the MiGs had been pursuing squadromates Lts Charlie Plumb and Don Monk in ‘Linfield 205’ (which had previously been damaged by 57 mm AAA), firing several missiles at them at treetop height – they had also been targeted by cannon fire.

Despite his aeroplane having also been hit by AAA over Kep, section leader Southwick managed to reverse behind one of the MiGs that passed overhead and fired an AIM-9D, which destroyed the VPAF fighter. However, he was being pursued by another MiG-17, which in turn was followed by Lt Hugh ‘Denny’ Wisely and Lt(jg) Gary Anderson in ‘Linfield 200’. Closing to Sidewinder range seconds later, Wisely fired a missile into the MiG-17’s tailpipe, demonstrating the effectiveness of VF-114’s recently received AIM-9Ds, with their wider angle of infrared ‘vision’ that enabled Wisely to fire at 30 degrees angle off the target. As they headed for the coast Lt Cdr Southwick realised that the flak damage had prevented the fuel transfer system from accessing the fuel in his wing tanks. He and Ens Laing ejected (from BuNo 153000), this event being famously captured on film by Lt(jg) Anderson in ‘Linfield 200’.

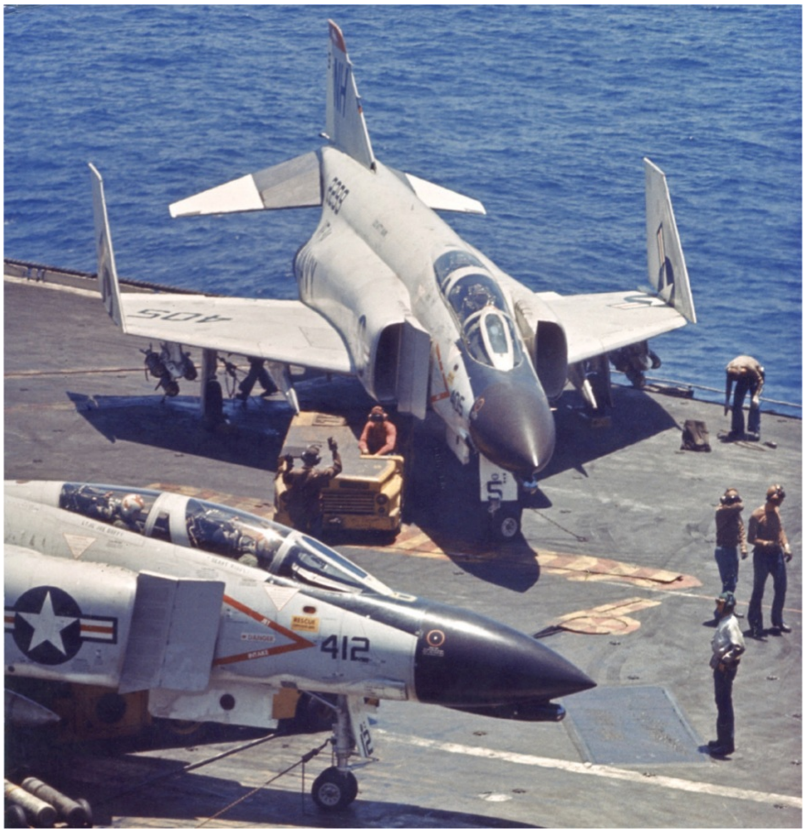
Three weeks after their recovery from the sea Southwick and Lt Jack Rollins flew ‘Linfield 201’ (BuNo 153001) in a flak suppression flight for the Ham Rong bridge attack by 25 CVW-11 aircraft that would result in a second ejection for Southwick. Their VF-114 flight was scheduled to hit the known AAA batteries with 16 Zunis 20 seconds before the A-4 and A-6 bombers struck the bridge. The attack by the three-aircraft flight was made in a 45-degree dive after a 'pop-up' to 11,000 ft, firing their Zunis at 5000 ft and pulling out above 3000 ft at more than 500 knots. All three expended their four LAU-10/A pods at once, directed at the guns that were already firing huge quantities of shells at them.

As 'Linfield 201' pulled up it was clear that the right engine had flamed out, probably due to Zuni debris entering the intake and damaging the engine's stator vanes and compressor. The left engine also began to lose power seconds later with similar debris damage, and both J79s soon overheated. As the aircraft's electrical power faded Southwick glided the Phantom II along the course of the Ma River, hoping to make the eight miles to the coast, but they had to eject and the F-4B belly-landed in muddy tidal flats a few seconds later. Southwick and Rollins were quickly captured, the latter with back injuries caused by a partially deployed parachute.

In an attempt to prevent the virtually intact F-4B from falling into enemy hands as well, flights of A-4s dropped 16 Mk 82s and eight Mk 81s on it, claiming that the jet was thereby 'probably destroyed'. However, photos from an RA-5C a day later showed it to be substantially undamaged. Very soon, local villagers managed to drag the F-4B onto barges and tow it under cover in a bamboo grove. There, it was stripped for examination by Vietnamese (and probably Soviet) technicians and the gutted airframe was eventually put on permanent display, with an F-105 canopy in place of its own, in the Hanoi Air Defence Museum, where Southwick and Rollins were able to re-visit it in 2004.

Jim Laing, Southwick's former RIO, had to eject once again on 21 May when 'Linfield 213' (BuNo 153040) was hit by AAA over Hanoi and pilot Lt Hugh Wisely managed to coax the Phantom II to fly them out over northern Laos, despite extensive damage to both hydraulic and pneumatic systems. Laing punched out at around 450 knots and his parachute opened before his seat had completely left the aircraft, breaking his arm. Lt David Georgius flew his SH-3A Sea King right across North Vietnam to try and find the 'Linfield' crew but he collected three AAA hits en route and also had to crash-land in Laos. All crewmen were eventually picked up by other rescue helicopters, including Wisely, who had landed on top of a 200-ft tall tree. It was one of many exceptionally brave attempts to rescue downed F-4 aircrew.

Another, on 20 March 1966, involved Lt James Greenwood and Lt(jg) Richard Razloff of VF-92. As they delivered Mk 82 Snakeye bombs at an altitude of 100 ft during an evening armed reconnaissance, their F-4B 'Silver Kite 202' (BuNo 151410) was hit by AAA or bomb debris and they had to eject a short distance out from the beach. Razloff was quickly captured, as he had landed within wading distance of the shore, but Greenwood became the focus of a vicious gun battle between the crew of a sampan and a door gunner in a HC-1 Det 5 UH-2 Seasprite helicopter, with four Skyhawks from *Enterprise* contributing 20 mm strafing runs on 20 encroaching enemy boats. An HU-16 Albatross rescue amphibian was hit, preventing it from landing, but Greenwood was eventually hauled aboard the Seasprite.



VF-114 F-4Bs, still retaining the glass lenses of the AAA-4 IR sensors beneath their radomes, are prepared for launch from *Kitty Hawk* in 1966. The aeroplanes are armed with an assortment of small, World War 2-vintage general purpose bombs. 'Linfield 412' was assigned to Lt Denny Wisely (a future An-2 and MiG-17 killer) and Lt(jg) Joe Duffy (*McDonnell Douglas*)

Flak suppression also meant flying at low altitude to accurately identify the gun positions – a particularly hazardous occupation when low cloud obscured the poorly mapped, mountainous terrain of North Vietnam. Cdr Carl Austin and Lt(jg) Jacob Logan from VF-114 had to enter cloud, hoping to find a break in it for their attempt to protect an A-4 strike on 2 December 1965. The only evidence of their fate the next day was a patch of scorched ground close to their flightpath where 'Linfield 412' (F-4B BuNo 152220) had apparently flown into a hill.

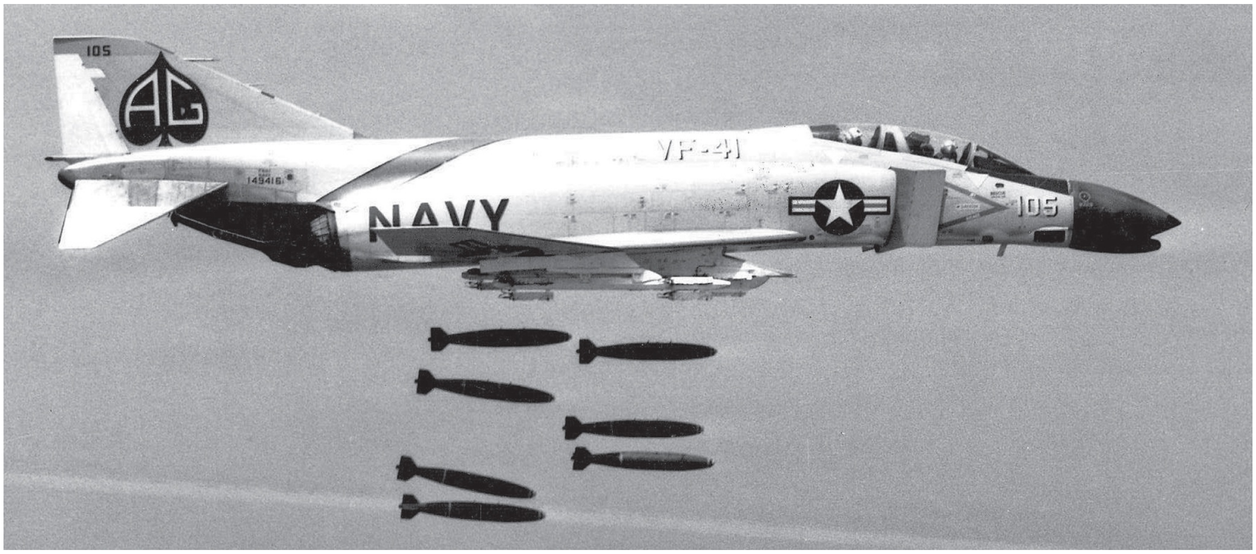
In one of the more dramatic flak suppression missions of October 1966, on the 9th Lt Cdr Charles Tanner and Lt Ross Terry of VF-154 were tasked with hitting AAA sites with 500-lb bombs during a CVW-15 Alpha strike on a railway bridge near Hanoi, reverting to TARCAP thereafter. As they rolled in to bomb, a 100 mm shell exploded under the aircraft, demolishing its electrical systems and severely damaging the two main hydraulic systems. The crew ejected safely at Mach 1.3 in a 60-degree inverted dive. In captivity, they were forcibly persuaded to say that they had been shot down by a MiG-21 to provide this VPAF type with its first 'kill'. Their assertion upon capture that their names were Clark Kent and Ben Casey did not improve the mood of their captors and brought severe beatings.

As partial recompense, VF-162 CO Cdr Dick Bellinger, in an F-8E, claimed the US Navy's first MiG-21 kill that same day, and a MiG-17 was shot down by Lt(jg) Tom Patton in one of the VA-176 A-1H Skyraiders that had been sent to provide rescue CAP (RESCAP) for Tanner and Terry. Two MiG-17s were also badly damaged by the prop-driven Skyraiders' gunfire.

CHAPTER THREE

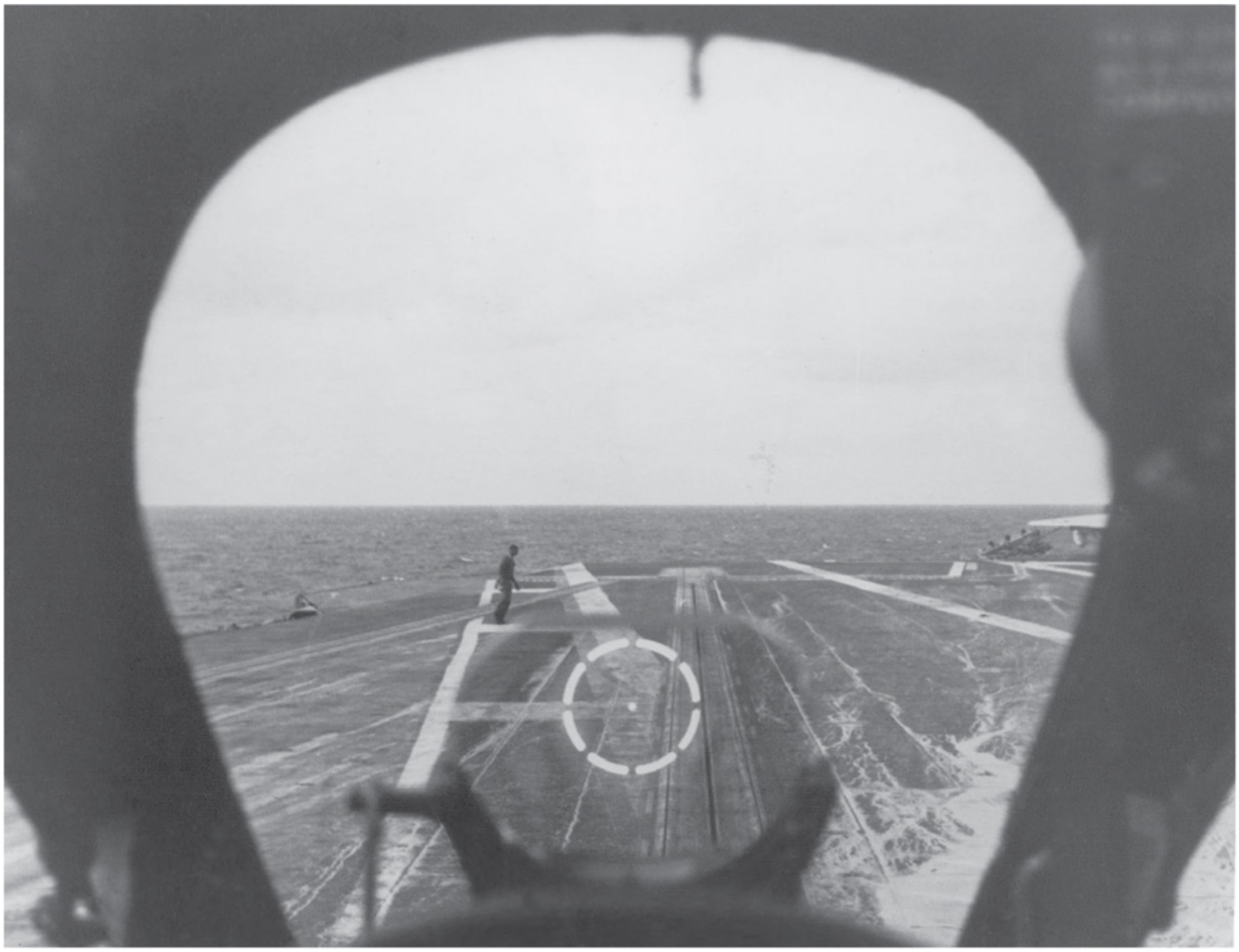
ADAPTATIONS

As the US Navy's F-4 crews established themselves in battle several aircraft modifications were seen to be necessary to cope with unexpected demands, particularly with the emphasis being placed on ground attack. One of the first requirements was an adequate bombsight for ground attack in a fighter that was originally meant to carry only a single nuclear weapon in a secondary role. Obviously, that weapon did not require precise aiming, whereas hitting individual vehicles or small buildings in Vietnam with 'dumb' bombs demanded considerable skill and accuracy.



Mk 82 bombs fall from VF-41 'Black Aces' F-4B-09-MC BuNo 149416 as it makes one of the straight-and-level radar-guided deliveries championed by the CO, Cdr Bob Gormley, before the squadron entered combat in May 1965 alongside VF-84 as part of CVW-7 embarked in *Independence*. This aeroplane was lost to AAA near Thach Ban, in North Vietnam, on 19 August 1969 whilst serving with VMFA-542 (*US Navy*)

VF-96 adopted a pragmatic approach in August 1964 by adapting an old-technology A-1 Skyraider visual sight. This device had a moveable reflection plate rather than the fixed component in the F-4B, and a knob was used to enter lead angles in ‘mils’ for bombing. When the ‘Fighting Falcons’ arrived at the US Navy facility at Subic Bay en route to battle they had a number of metal collars specially cast to fit the gunsights to the F-4 sight bases, while retaining a ‘pipper’ for air-to-air missile aiming. Settings for various types of ordnance, and their associated dive angles, were calculated and practice deliveries of Mk 81 bombs and Zunis took place at NAS Cubi Point, with an emphasis on flak suppression tactics. Although the system usually needed resetting after each carrier landing due to the shock of a ‘trap’, it provided a basic bomb-aiming method that was adopted by other squadrons.



A pilot’s-eye view through the jury-rigged weapons sight of a VF-96 F-4B as it takes its catapult position on a storm-swept deck in 1964. Many of the Mk 20 Mod 4 sights adapted for the F-4B came from A-1 Skyraider supplies (*Cdr R W Fraser/US Navy*)

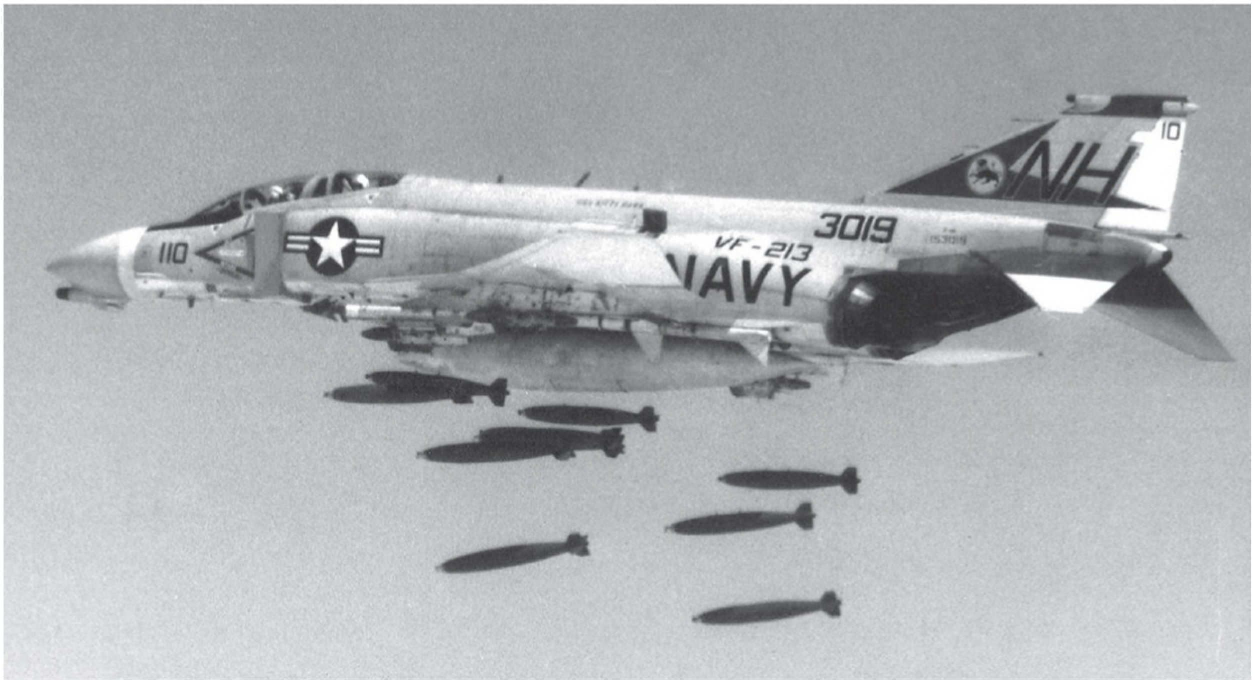
VF-41 ‘Black Aces’, which made a single combat cruise aboard *Independence* in 1965, improvised a similar ‘iron sight’ system in 1964-65, but also experimented with the APQ-72 radar for air-to-ground use as Capt Fred Staudenmayer recalled;

‘Our skipper, Bob Gormley, was very keen on getting the fighters into the “air-to-mud” business and was interested in using our radar for level bomb drops using time, speed and distance dead reckoning to drop on mark. For instance, our radar had a ten-mile scope, and we would “paint” targets, put them on the nose and fly at 360 knots. At six miles’ distance we would start the clock and “pickle” the bombs at a fixed number of seconds. The radar was outstanding for ingress navigation and was okay for ship targets and even junk-sized “floaters” if the seas were not too extreme. Our preference was for TERs on the outboard wing stations so that we could keep missiles on the inboard wing stations and the ever-present centreline tank. I think VF-41 was the only squadron that pursued this level-bombing tactic. After all, we were fighter jocks! Once the squadrons got into Vietnam, however, almost all bombing was dive-bombing, during which RIOs were indispensable for calling off altitudes and speeds so that the pilots could adjust their runs.’

Developing effective bombing tactics required a trial-and-error approach, as John Nash of VF-213, embarked in *Kitty Hawk*, explained;

‘We delivered napalm and CBUs, but the big problem was that when you were at really low altitude in level delivery you couldn’t see your target until it was under the nose because of jungle cover. Delivery of napalm in this way was almost impossible over South Vietnam because the targets were usually in small clearings, and you couldn’t see those. We went to a minimum ten-degree dive delivery for CBUs and napalm. I used a 30-degree dive with a 3000 ft release point. Everyone had their own techniques.’

Small targets, many of them structures such as temporary foot-bridges across streams or individual rafts and boats, put the aircraft at considerable risk as the pilot tried to focus his rudimentary bomb-aiming equipment. The enemy often surrounded such targets with 23 mm light AAA and awaited the F-4’s arrival, but there were also other hazards.



Fitting TERs to the inboard pylons allowed the carriage of up to four AIM-9 missiles as well as Mk 82 bombs. VF-213 'Black Lions' F-4B-26-MC BuNo 153019 also has two AIM-7Es in the rear missile wells – a fairly standard configuration for optimum centreof-gravity on deck launch. In later service with VF-111 this Phantom II was a MiG killer for Lt Garry Weigand and Lt(jg) Bill Freckleton in March 1972. It has the AN/APR-30 ECM fit with a hook-shaped antenna below the radome (*US Navy*)

F-4B BuNo 152255 from VF-114 was lost on 26 April 1966 after dropping Mk 82 bombs on weapons-carrying junks near Vinh. Although Lt(jg)s W W Smith and R Blake managed to return to *Kitty Hawk*, damage to the hydraulics meant that they could not lower the flaps or undercarriage and they had to eject. The damage was probably caused by pieces of debris from the exploding boats or by bomb shrapnel. Their squadron had also devised its own bombsights and delivery tactics using Skyraider sights scavenged from the US Navy storage facility at Litchfield Park, in Arizona. They replaced the existing Westinghouse sights, while squadron members Dave Coker and Fritz Klumpp worked out settings for dropping bombs at various dive angles and altitudes.

FOOLING SAMs

The threat posed by SA-2 'Guideline' SAMs required an urgent response before it made losses in *Rolling Thunder* unsustainable. The weapon had been used to shoot down a CIA Lockheed U-2C reconnaissance aircraft over Russia in May 1960, causing a major international incident. A U-2F was destroyed over Cuba in

October 1962 during the Cuban Missile Crisis and this almost resulted in 500 US bombing sorties being directed at the 144 SA-2 launchers that had been installed in Cuba with Soviet operators.

The Pentagon was understandably alarmed at the prospect of numerous SA-2s being placed in the comparatively small North Vietnamese target area around Hanoi and Haiphong, where many US aircraft were operating daily. In an urgent programme of research USAF technicians were able to study the SA-2's limits of manoeuvrability, using replica models and also data gleaned from 'spook' electronic reconnaissance missions by aircraft based at Wiesbaden, in West Germany, that probed the East German border in order to read SAM radar signals. Its guidance and fusing system data were also recorded by a modified Ryan target drone just before the aircraft was shot down by SA-2s in February 1966. This information was used by the US Navy in a rushed programme to protect its F-4s, A-4s and A-6s as they faced a rapidly expanding SAM 'belt' in North Vietnam.

Naval Aviators entering combat could expect little preparation or training to cope with SAMs, but after July 1965 many learned from experience that waiting until the missile was perilously close and then performing a high-g rolling, diving manoeuvre at exactly the right moment could be a way to evade it. However, as F-4 pilot Jerry Houston pointed out, there were no standard tactics. 'All that "BS" about planned manoeuvres against SAMs you can see and track – most of those droll pearls came from PoW experts'. Guy Freeborn saw SAMs as 'the greatest threat. There were so many of them, and they were more "human" because they could track us'.

In addition to protecting strike flights, F-4 squadrons had to accompany RA-5Cs (top left) and Da Nang-based EA-3B ECM aircraft on their electronic and signal intelligence-gathering flights using their Tactical Airborne Signal Exploitation System (TASES), usually at night. These 'Queer Whales' had sensors to direct F-4s against moving targets on the Ho Chi Minh trails. Escort flights were also sometimes provided for Lockheed OP-2E Neptunes from VO-67, dropping 'Igloo White' sensors along the trails to detect moving targets. *Kitty Hawk*'s aircraft (including VF-213's F-4Bs seen here) also flew myriad BARCAP missions between January and March 1967, contributing more than 1000 sorties to Operation *Niagara* – the relief of the US Marine Corps base at Khe Sanh. They also provided extensive air support for US and South Vietnamese troops opposing the 1968 Tet offensive (*US Navy*)

The US Navy-sponsored Texas Instruments AGM-45 Shrike anti-radiation missile was an early attempt at knocking out the 'Fan Song' radar guidance units for SA-2 missiles. Carried by *Iron Hand* A-4 Skyhawks as an alternative to their AGM-12 Bullpup guided bombs, the missiles usually damaged the 'Fan Song's' antennas, requiring further attention from A-4 or F-4 bombers to destroy the site fully. The Shrike could also be defeated simply by turning the 'Fan Song' off, breaking the missile's lock, or by 'juggling' the SA-2 launch signals between two 'Fan Songs' to confuse the Shrike.

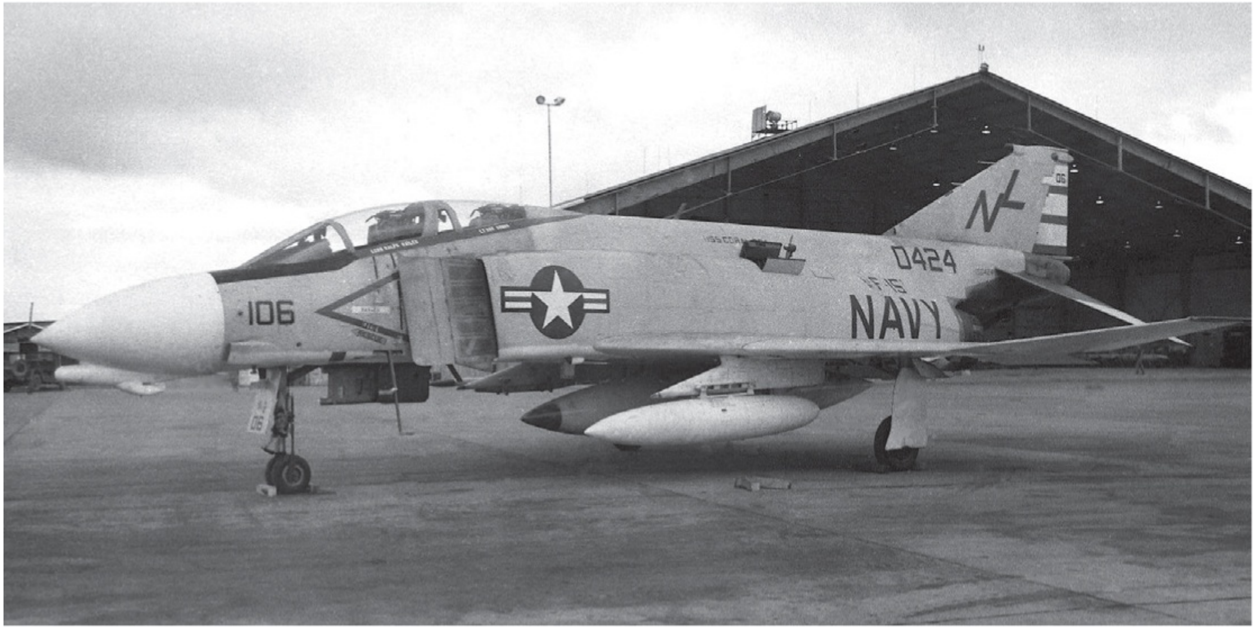
VF-96's 'Showtime 602' (BuNo 152283), displaying the squadron's early custom of repeating side-numbers on the upper surface of the wing, releases rockets against a ground target in 1965. The unit also flew its share of BARCAPs offshore, and they brought numerous disappointments. Typically, on 28 April 1966, a 'Fighting Falcons' section was vectored onto a bogie by an E-1B Tracer AEW aircraft and a SAR destroyer. The F-4Bs gave chase but the contact turned back towards Hanoi and the Phantom IIs had to break off when it was clear that they could not close within 15 miles of the VPAF fighter in order to take an AIM-7 shot (*McDonnell Douglas*)

The AGM-45 was developed during 1962-64 and it entered service in mid-1965. The USAF began to use the missile on F-105F Thunderchiefs a year later after seven of its aircraft were lost to SA-2s, but it chose noise-jamming equipment in external pods to defeat the hostile radars rather than the US Navy's AN/ALQ-51 internal track-breaking system. It also chose to modify specific aircraft such as the F-100F Super Sabre and F-105F for its *Wild Weasel* programme (which began more than three months after the US Navy's *Iron Hand* missions commenced) to detect and attack SAM sites rather than giving that mission to existing attack squadrons as the US Navy did.

In 1964 the US Navy pioneered the use of the Melpar AN/APR-23 Redhead radar threat receiver in selected A-4E Skyhawks, and these were used to attack SAM sites (the equipment warned of an imminent SA-2 launch) on 11 August 1965. A concerted search for SAM sites – Operation *Iron Hand* – began on 12 August, but seven aircraft were lost to AAA in 45 minutes during the hunt, which failed to find a single site. A better solution was found by installing the Sanders AN/ALQ-51 track-breaker equipment in several A-4Es in September 1965. This device sent a distorted version of the hostile radar emitter's signal back to it, telling the radar that the target aircraft was several hundred feet from its true position, or split the contact into several targets. It could also make SA-2 fuses detonate prematurely. This programme provided the basis for similar installations in the F-4B, although several other short-lived solutions were also tested. Rear Admiral 'Smoke' Wilson recalled;

‘We had just installed radar warning receivers in our airplanes – a real “Rube Goldberg” set-up [the Singer CMR 312 ‘Little Ears’ aural system], but it worked. In order to get the capability to have warning that a SAM radar had locked on, the troops fastened an aluminium bracket on the RIO’s glare shield and installed a navigation system antenna on it. It was plugged into a 24-volt utility receptacle. With a phone jack patched in, the high-pitched “deedle-deedle-deedle” that said “Look out! There’s a SAM coming your way!” would be heard by both crewmen.’

John Nash remembered that ‘Little Ears’ lasted about two weeks in VF-213 in 1966, although it was in VF-161’s F-4Bs in July of that year, when a MiG kill was credited to Lt Bill McGuigan and Lt(jg) Bob Fowler. Nash recalled, ‘They wanted to put it on the RIO’s helmet and have him turn his head and scan. They looked pretty queer in the back with those things on. It was effective, but strictly directional, and the RIOs were too busy to do that’. The device was attached to the canopy by suction cups, with a Y-shaped lead to the RIO’s helmet to provide limited general warning of a SAM launch somewhere in the area.



The ram-air turbine (RAT) extending from the upper fuselage of VF-151 F-4B-12-MC BuNo 150424 suggests a hydraulic emergency that could have led to this shore visit at Da Nang in 1967, although the travel pod on the inboard pylon might indicate a more official visit. The retractable crew entry ladder, seen here in the ‘boarding’ position, occasionally extended itself in flight. The Shoehorn ECM modifications added to this jet include AN/ALQ-51A antennas beneath the air intake ducts ahead of the wing root and just outboard of the underwing air brakes. Like many combat-weary early-build F-4Bs, this aircraft was passed on to the US Marine Corps in the late 1960s. Serving with VMFA-115, the aeroplane was shot down by ground fire near the Son Cu River, in South Vietnam, on 15 May 1970 (*US Navy*)

The first US Navy strike on a SAM site, near Kep airfield, was flown by CVW-7

A-4Es on 17 October 1965 in conjunction with a 15-aircraft attack on the Thai Nguyen road bridge near Hanoi. Three F-4Bs from *Independence*, one of them a flak suppressor, were shot down by AAA and small-arms fire rather than SAMs. During the briefing two hours prior to an Alpha strike, the location of known SAM sites was a priority for aircrew, and careful monitoring of SAM warnings, either via other crews or through the aircraft's internal radar warning devices, was essential. Ken 'Bullet' Baldry, with VF-96 in 1965, recalled a TARCAP near Hanoi;

'I remember seeing several classic "star" pattern SAM sites, most of which seemed unoccupied. The main big stuff and SAMs being hosed off were more up in the target area, but if you stuck your nose very far above 1500 ft altitude you would certainly get all the SAM alert tones you wanted. When the strike leader called "Off target" we all headed for the mountains to the south. There was a hell of a lot of smoke, flak and SAM trails still coming out of the target area and we were still jinking hard at low altitude until we got to the relative safety of the mountains.'

SAM-operating troops could move their missiles and support equipment overnight using purpose-built ZIL-157 tractor and semi-trailer units to transport the SA-2s and their SM-63-1 launchers, while the 'Fan Song' and 'Spoon Rest-A' radar units travelled in their own vans and ZIL trucks. It was always difficult to predict which sites would have missile batteries in place when the strike force arrived.

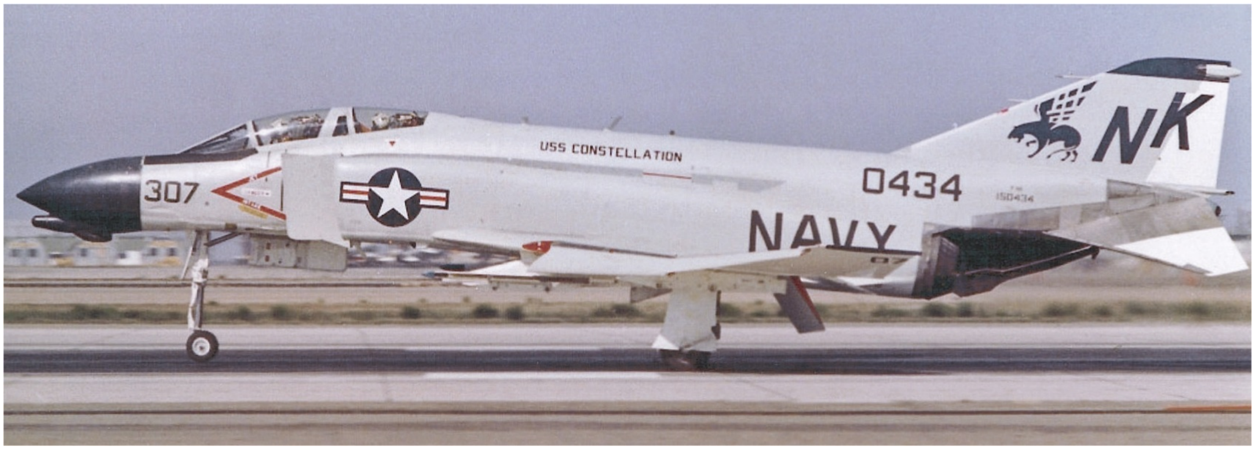
Ken Baldry had a chance to see how effective a Shrike shot could be during one of the early daytime strikes on Kep air base by eight A-6As and F-4Bs from *Enterprise*;

'There were 16 F-4Bs from VF-92 and VF-96 armed with electrically fused bombs. We coasted in over a low mountain range to the north of Haiphong and were doing much warp. As we closed on Kep one SAM alert was noted and immediately one was fired from the area of Kep. As the SAM climbed you could see a smoke trail from a Shrike almost collide with the SAM and then impact with the ground. The SA-2 promptly went stupid, climbed straight up and detonated far above the strike group. No more SAMs were fired during that particular strike, and we were pretty sure that the Shrike had hit the missile's control radar ["Fan Song"].'

A re-configured version of AN/ALQ-51 was progressively installed in naval F-4Bs, RF-4Bs and A-4s from April 1966 in Project Shoehorn, a programme which was initiated for the E-model Skyhawk in August 1965 at a time when it was thought to be unnecessary for F-4Bs. Its 'dirt pounding' missions had made the A-4 particularly vulnerable – USS *Oriskany* (CVA-34) lost 23 A-4Es and 16 other aircraft during one 1968 cruise, 11 of them to SA-2s. The Shoehorn title reflected the difficulty in finding space for the installation within the A-4 and F-4 airframes.

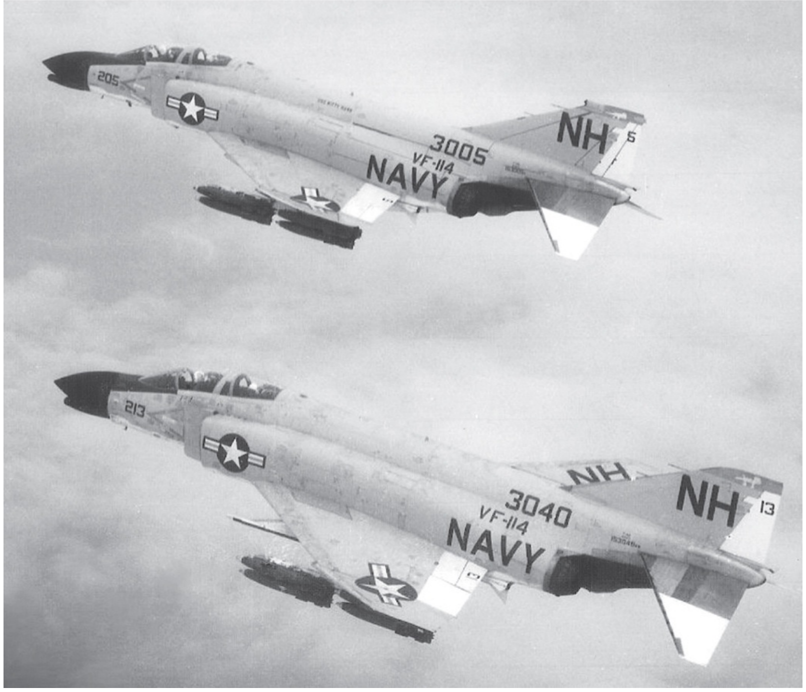
At the same time, 30-shot Goodyear/Tracor AN/ALE-29 chaff dispensers were installed in bays behind Doors 622L/R on each side of the F-4's upper rear fuselage. These fired cartridges that created clouds of small metal strips to distract an oncoming SA-2, or they could dispense flares to decoy infrared missiles such as the R-3S 'Atoll'. For the Phantom II, Shoehorn was, at the time, 'the largest retro-fit change ever attempted on the F-4', according to Support Programme Manager John Harty. 'We even had to remove the aft fuselage to install some of the provisions. The biggest challenge was running the wire bundles from the Group B equipment to the cockpit displays'.

There were variations on this ECM fit during and before Project Shoehorn, each with slightly different antennas on the F-4s' fin caps and empty AAA-4 IR fairings, reflecting the rapid development of ECM equipment and modifications to match changes in the hostile radar emitters. Carrier air wings often included F-4Bs with various versions of the ECM fits, or none at all. The Melpar AN/APR-24 radar homing and warning system, covering C/S/X-band radar emissions, was installed in about half the aircraft of VF-151 and VF-161 embarked in *Constellation*, VF-96 on *Enterprise* and VF-14 and VF-32 on *Franklin D Roosevelt* for their 1966-67 Vietnam cruises. It was removed afterwards partly because it was very susceptible to rain erosion.



A VF-143 Phantom II in the squadron's later markings, with the griffin motif (understandably mistaken for a vomiting dog) moved to the tail, where it remained after transition to the F-4J in 1969. This jet's ECM fit includes AN/APR-30 fairings, but without the forward hemisphere antenna fairing on the front of the fin cap – a feature peculiar to F-4Bs with the Shoehorn Mod 3 installation assigned to VF-142 and VF-143 in 1968. This F-4B-12-MC was lost on 24 August of that year when a catapult bridle link failed on launch from CVA-64 and the Phantom II plunged into the sea. Although pilot Lt W A Heep was killed, RIO Lt(jg) T L McPherson ejected and was rescued (*US Navy*)

F-4Bs making those cruises also received kits for installation of the Magnavox AN/APR-27 missile warning system. This device fitted into the space for the pilot's map case, and it shared the disc-shaped antenna on the aft nose-gear door used by the TACtical Air Navigation (TACAN) equipment. It gave audible warning that a SAM had been launched in the vicinity of the aircraft. Onboard *Constellation* for the vessel's 1967 TF 77 deployment, F-4Bs from VF-142 and VF-143 received an early version of the Applied Technology Inc AN/APR-25 system that formed the basis of the USAF's countermeasures fit on some of its tactical aircraft, including the Phantom II. This system had originally been sponsored by the CIA for use in its U-2 reconnaissance aircraft.



Another version of the F-4B's ordnance configurations was a load of eight Mk 82SE Snakeyes on outboard MERs and AIM-7s in the rear wells. VF-114 was part of CVW-11 with VF-213. Unlike other carrier air wings assigned to TF 77 that moved to different vessels when their usual ship was in for major maintenance, CVW-11 completed six consecutive combat deployments embarked in *Kitty Hawk*. Both these F-4Bs were VF-114 casualties in 1967, BuNo 153040, with Lt Dennis Wisely and Ens Jim Laing aboard, being hit by AAA while evading three SAMs on 21 May (the crew ejected and was rescued), and BuNo 153005 crashing during a loft bombing manoeuvre on 27 December (killing Lt Cdr L M Lee and Lt(jg) R B Innes) (*US Navy*)

Project Shoehorn, in three stages for the Phantom II, was intended to standardise an F-4B ECM suite so that it included the Melpar AN/APR-30 (with a hook-shaped antenna below the former AAA-4 fairing under the radome), a Sanders AN/ALQ-51 deception jammer, AN/APR-27 and AN/ALE-29. It also had to be modified to cure interference problems with the AIM-7 guidance system. The second and third versions of Shoehorn retained AN/APR-27 combined with the radar-homing and warning (RHAW) elements of the USAF's AN/APR-25, which was found to be more reliable than the AN/APR-30. AN/ALQ-51 was replaced by the more versatile AN/ALQ-100, which could also fool the proximity fuses in air-to-air missiles and AAA shells. When the F-4J Phantom II joined the fleet in 1968 with VF-33 and VF-102 (embarked in CVA-66), it received Shoehorn 4 modifications during production that were similar to the F-4B's Shoehorn 3 array, including the Magnavox AN/ALQ-91 IFF countermeasures system and a Hazeltine AN/APX-76 air-to-air IFF system.

While all these sophisticated systems did much to reassure crews that SA-2s could be beaten, many found their frequent aural and visual warnings both confusing and distracting in the heat of battle. More than a few experienced pilots chose to turn them off when the sensory load became unbearable, relying on their own eyes or those of their RIO as the principal SAM detectors. It was quite common for crews to put as much of their electronic equipment as possible into 'standby' mode when crossing the coast inbound to deny hostile radars the chance to home in on the F-4's emissions. This policy also allowed the RIO to prioritise a visual scan of the sky to look out for MiGs, particularly those approaching from the rear quarter.

Iron Hand and USAF *Wild Weasel* activities took a considerable toll on enemy defences, but the Soviet Union continued to supply many more SA-2s, increasing the number of launch sites from 59 in December 1965 to 139 by the end of 1966. In 1967 SAMs accounted for six times more US losses than the MiG force achieved. However, this still represented less than eight per cent of the total American fixed-wing losses, AAA accounting for most of the others. Ten F-4B/Js were lost to SA-2s in all, including six while flying CAP orbits and two during hazardous flak suppression missions.

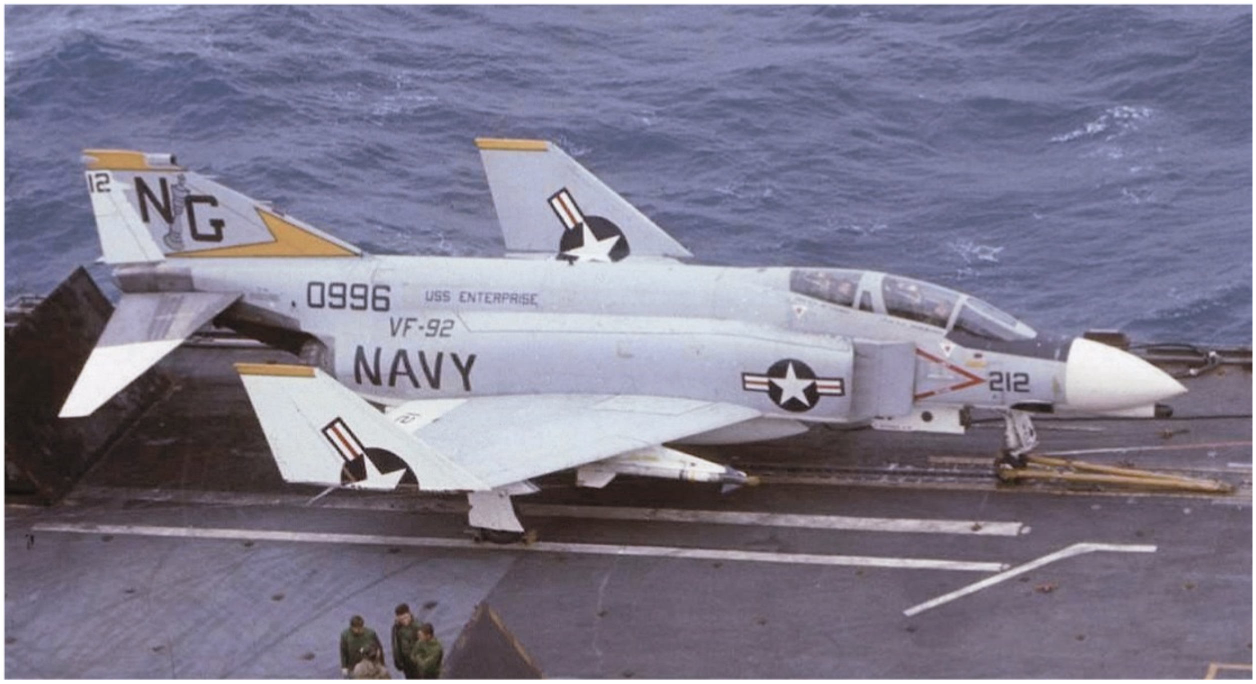
The first two CAP losses were at higher altitudes when F-4Bs were hit by single, unseen SA-2s. On 19 May 1967 the US Navy made its first attacks on Hanoi itself, and the strike was met by unprecedented volleys of SAMs that drove the Alpha force to lower altitudes and put it at greater risk from AAA. Two CAP F-4Bs were destroyed, the first ('Showtime 604', BuNo 152264) at 3000 ft. Section leader Cdr Richard Rich, VF-96's executive officer, and his RIO Lt Cdr William Stark tried to evade a barrage of SA-2s but their aircraft was hit twice, killing Cdr Rich. Lt Cdr Stark managed to eject and became a PoW. An hour later, Lt(jg) Joseph Plumb and Gareth Anderson were also captured after escaping from their blazing VF-114 F-4B 'Linfield 204' (BuNo 153004). Despite Plumb's violent evasive manoeuvres in the face of numerous SA-2s, one of the SAMs exploded directly beneath the Phantom

II's underside and sheared off its tail section.

Photographed shortly after VF-154 had commenced its first Westpac with the F-4B on 29 July 1966, F-4B-23-MC BuNo 152304 did not retain this spotless finish for long once CVA-43 had checked in with TF 77 less than a fortnight later. Passed on to VF-151 after VF-154 returned to Miramar in the early spring of 1967, the jet (again embarked in CVA-43, which was now home to CVW-15) was one of two 'Vigilantes' F-4Bs bounced and shot down in a MiG-17 ambush near Haiphong on 19 November 1967. BuNo 152304's pilot, Lt(jg) James Teague, was killed and RIO Lt(jg) Theodore Stier captured (*US Navy*)

Phuc Yen (Noi Bai) MiG base was approved as a target for the first time on 24 October 1967, and both USAF and US Navy aircraft took the long-awaited opportunity to attack it. F-4B squadrons provided several CAP flights, including a VF-151 section from *Coral Sea* led by the unit CO, Cdr Charles Gillespie, with RIO Lt(jg) Richard Clark. As they flew along 'Thud Ridge' (the nickname used by F-105 pilots for the 5000-ft-high Tam Dao range that runs for 15 miles parallel to the Red River, approximately 20 miles northwest of Hanoi) towards the target, an SA-2 battery released a standard three-missile salvo. Gillespie dived to avoid one SAM, but his F-4B (BuNo 150421) was hit by a second missile. Both crew ejected but only Gillespie survived captivity in Hanoi.

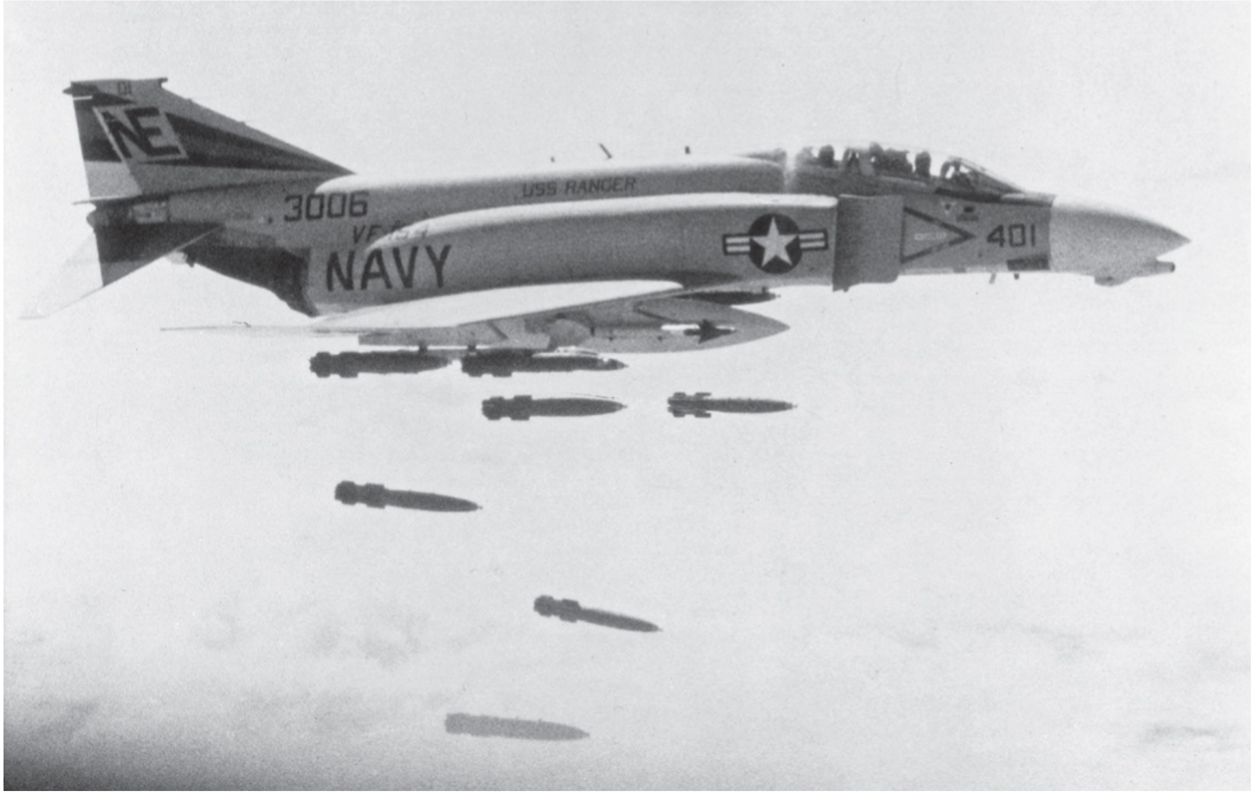
The remaining members of Gillespie's 'Vigilantes' flight flew RESCAP for their boss in case a rescue helicopter could be brought in, but in the process Lt(jg)s Robert Frishman and Earl Lewis, in F-4B BuNo 150995, were hit at 10,000 ft by another SA-2. The Phantom II, which lost an engine to the first missile, was then hit by a second SAM moments later. Both crewmen ejected and were quickly captured. Although this raid had cost VF-151 two F-4Bs, nine MiGs had reportedly been hit on the ground, with ten more destroyed the following day during additional strikes by both US Navy aircraft and USAF Thunderchiefs and Phantom IIs. The Johnson administration's decision to suspend further attacks meant that the damage was soon repaired, however. Furthermore, the VPAF often moved its MiGs to safer bases like Gia Lam (closer to Hanoi) or across the border into China when the threat of airfield attacks was relayed through its intelligence network.



VF-92 F-4B-15-MC BuNo 150996 has the Melpar AN/APR-24 ECM additions to its fin cap that were fitted to some aircraft in 1966, preceding the AN/APR-30 installation. F-4Bs on CVAN-65's 1965-66 Westpac cruise were unique in having the GAINTIME airborne IFF interrogator fitted. This device enabled them to detect the MK X IFF signals of Soviet aircraft that used derivatives of the SRO-2 IFF transponder unit, so that targets could be positively identified as hostile before BVR missiles were fired at them. The USAF's later 'Combat Tree' equipment offered a more complex variation on this process (*US Navy via Moggeridge*)

Barrage launching of SAMs was the expensive North Vietnamese way of increasing the chances of a hit. In the cases of both the Phuc Yen flak suppression losses the F-4B crews faced multiple launches and evaded the first one or two with violent manoeuvres, but their Phantom IIs thereby lost so much energy that a third or fourth missile could not be beaten. Lt Cdr Tom Sitek and Ens Patrick Ness of VF-142 were tasked with keeping down the flak for an attack by *Constellation*'s aircraft on a railway marshalling yard near Hanoi on 23 August 1967. Having outmanoeuvred two SAMs at 8000 ft, they levelled out briefly and were immediately hit by the third missile. Both men died in the conflagration. It was the second flak suppression loss for the squadron in just 72 hours, MiG-killer F-4B

BuNo 152247 having fallen to an AAA hit on the 21st – pilot Cdr Robin McGlohn and RIO Lt(jg) J M McIlrath were successfully rescued.



Many bombing missions, including radar-guided drops, were in support of ground troops. This VF-154 'Black Knights' F-4B is delivering Snakeyes on a North Vietnamese artillery position that was threatening US Marines' movements near the demilitarised zone (DMZ). The squadron made five wartime Phantom II deployments embarked in *Ranger* up to June 1973 after an initial Westpac cruise onboard *Coral Sea* in 1966-67. Its first exposure to combat in Vietnam had come flying F-8Ds from CVA-43 in 1964-65 (*J L McDowell/US Navy via Norm Taylor*)

Lt Cdr Paul Schultz and Lt(jg) Timothy Sullivan of VF-151 faced even stronger opposition during their flak suppression task on 16 November 1967. Their F-4B (BuNo 152987) became the target for four simultaneously fired SA-2s as Schultz began to dive and turn to evade the first missile. A solid overcast had prevented him from seeing them until it was too late, the 420-lb warhead of one of the Mach 3 weapons striking the aircraft and forcing the crew to eject into captivity.

Perhaps the most ironic SAM casualty was the VF-92 F-4B (BuNo 151485) of Lt Cdr E S Christensen and Lt(jg) W A Kramer on 7 May 1968. Having survived a dogfight with several MiG-21s during a CAP north of Vinh, despite having non-functioning radar or any SA-2 jamming support, the jet was hit by an unseen SAM (the VPAF claimed that the aeroplane was downed by an 'Atoll') as the crew levelled off at 8000 ft to fly out over the coast, thinking they had escaped the worst. Both Christensen and Kramer were rescued. Even the finely judged but strenuous contortions required to defeat an SA-2 that was seen to be approaching an F-4 head-on could induce a stall and loss of control, or, in the worst case, disorientate the pilot at night and at low altitude so that he flew into the ground. Lt(jg)s Don Brown and Thomas Pilkington of VF-154 (in F-4B BuNo 152985) may well have lost their lives in this way on the night of 19 September 1966 when a SAM warning was accompanied by an order to dive and head out to sea, followed by an explosion on the ground near their flightpath.

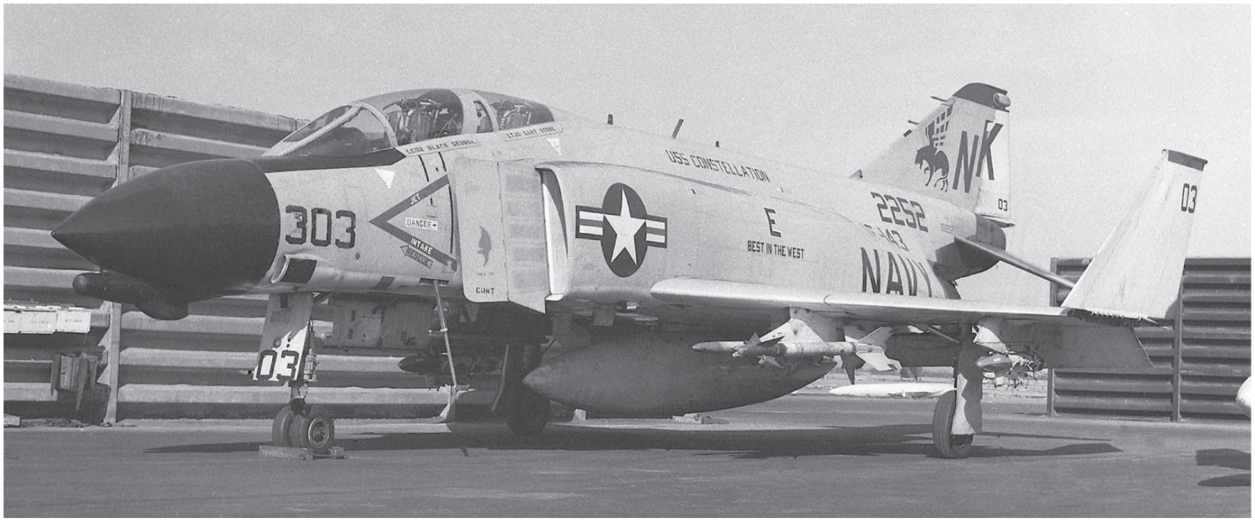
LT BROCCOLI FRAWLEY
LT JG CABBAGE CHRISTENSEN

Lt William 'Broccoli' Frawley and Lt(jg) William 'Cabbage' Christensen were lost on 1 March 1966 during a coastal reconnaissance under a 500-ft cloud base with visibility in poor weather of less than a mile. Their VF-143 F-4B (BuNo 150443) disappeared into the sea while making a level 180-degree turn in an attempt to avoid a SAM (*R L Lawson/US Navy*)

Disorientation took various forms and many F-4 pilots suffered from it during the enormous acceleration of a nighttime catapult launch. Hours after Brown and Pilkington's aircraft crashed, VF-151's Lt Frank Brown and Lt(jg) David Henry plunged into the sea in F-4B BuNo 152315 seconds after launching from *Constellation*, probably due to Brown's vertigo. Bombing under the dazzling, surreal light of flares during nocturnal missions could also induce fatal vertigo, and it was the likely cause of several losses, including the deaths of Lt Cdr James Bauder and Lt(jg) James Mills of VF-21 the following day in F-4B BuNo 152973. As one of a pair of F-4Bs dropping flares to illuminate each other's bombing passes during a road reconnaissance mission, Bauder was diving to bomb by flare-light when his radio transmission suddenly stopped mid-sentence as the aircraft apparently hit the ground.

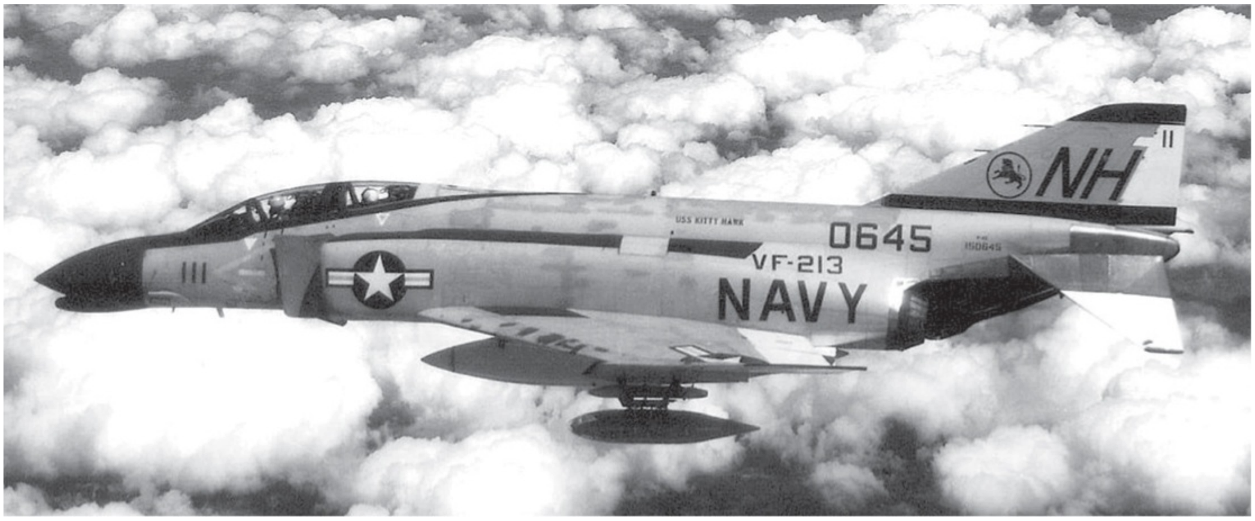
A similar accident occurred to VF-213 F-4B BuNo 153007 on 4 February 1967 during a mission in which flares from the section leader's 'Black Lion 105' Phantom II did not ignite – the Mk 24 flare had a 50 per cent 'dud rate' at that time. Seconds later a bright explosion on the pitch-dark terrain indicated that his wingmen (pilot Lt Donald Thompson and RIO Lt Allan Collamore) in 'Black Lion 102' must have flown into the ground. Cdr Edgar Rawsthorne, commander of VF-92, and his RIO Lt Arthur Hill appear to have suffered a very similar fate while attacking trucks by flare-light in F-4B BuNo 151412 on 28 December 1965.

VF-14 RIO Chuck D'Ambrosia observed that bombing under flares was 'probably the least productive and most dangerous type of mission we flew. Because of the haze the world would light up like a giant illuminated milk bowl. It was impossible not to get disorientated. Also, it was impossible to see anything on the ground when diving at 450 knots in a 40-degree dive angle. After pull-off it was always a scramble to avoid a mid-air collision with your wingman. Nobody had lights on, of course'.



Self-professed the 'Best in the West', VF-143 operated F-4B-22-MC BuNo 152252, assigned to Lt Cdr 'Black' George and Lt(jg) Gary Stone, from CVA-64 in 1968-69. Photographed during a brief visit to Da Nang, the jet has acquired a 'zap' from US Marine Corps F-4B unit VMFA-115 'Silver Eagles' on its port variable intake ramp. Late production F-4Bs had a slanting UHF antenna on the fuselage spine and (in some cases) a slotted stabilator. (US Navy)

Flying over water at low altitude could also be notoriously disorientating, particularly when there was low cloud or mist. A 23 June 1966 BARCAP for VF-151's Lt(jg) Lawrence Nyman and Ens Harry Belknap ended in tragedy when the disorientated pilot flew into the sea in F-4B BuNo 152324, vanishing without trace. A similar fate befell Lt William 'Broccoli' Frawley and Lt(jg) William 'Cabbage' Christensen on a coastal reconnaissance under a 500-ft cloud base with visibility in poor weather of less than a mile on 1 March 1966. Their VF-143 F-4B (BuNo 150443) disappeared into the sea while making a 180-degree turn in an attempt to avoid a SAM. Lt(jg)s Warren Boles and Ronald Roehrich were lost in their VF-114 F-4B (BuNo 153055) during an 18 January 1968 BARCAP. They were descending through overcast, attempting to identify a merchant vessel that was approaching the outer limits of the fleet off Thanh Hoa, when contact was lost. All that remained of the jet was an oil slick on the water. Like so many other Vietnam F-4 missions, ship identification was a curious task to perform in a multi-million dollar, high-altitude, supersonic interceptor.

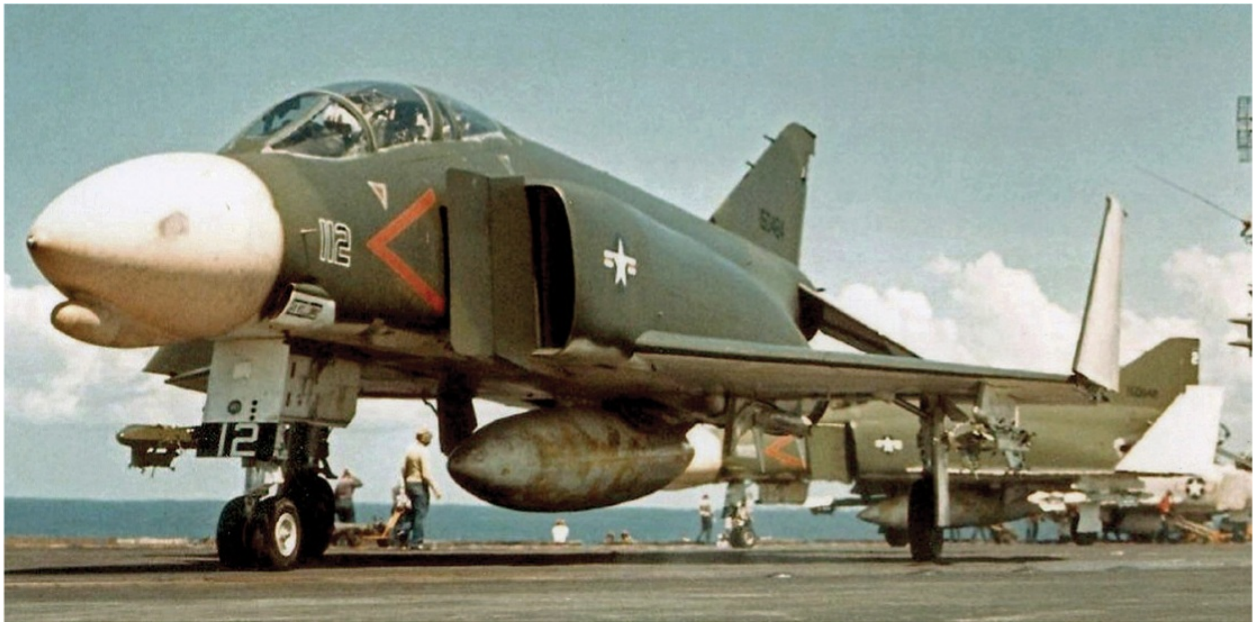


F-4G BuNo 150645 was photographed on 20 February 1965 with standard black, early VF-213 'Black Lions' markings and a cargo pod. Externally similar to the F-4B, the G-model was identifiable by a retractable radar reflector, extended ahead of the lowered nose landing gear, to enable automatic landings via the carrier's AN/SPN-10 radar. As 'Black Lion 111', BuNo 150645 was hit on 28 April 1966 while making a rocket attack from 2000 ft on some junks two miles off the North Vietnamese coast. Fire spread through the aircraft as Lt R A Schiltz and Lt(jg) D C Lewis attempted to return to *Kitty Hawk*, forcing them to eject. It was the only F-4G combat loss (*R L Lawson/US Navy*)

ROBOT PHANTOM IIs

The most elaborate scheme to increase the F-4B's already considerable versatility was instigated very early in its life. Three F-4As tested a data-link system similar to the USAF's method of directing its interceptors to their targets automatically without using voice contact with a ground controller. The US Navy intended to similarly link its ships, F-4Bs and Grumman E-2A Hawkeye airborne early warning aircraft. The Phantom II's autopilot was linked to a two-way UHF radio net, providing information on its fuel, armament and position status, while the ship could relay interception instructions through an E-2 directly to the F-4's autopilot, with a data display for the pilot to see and acknowledge via the press of a button.

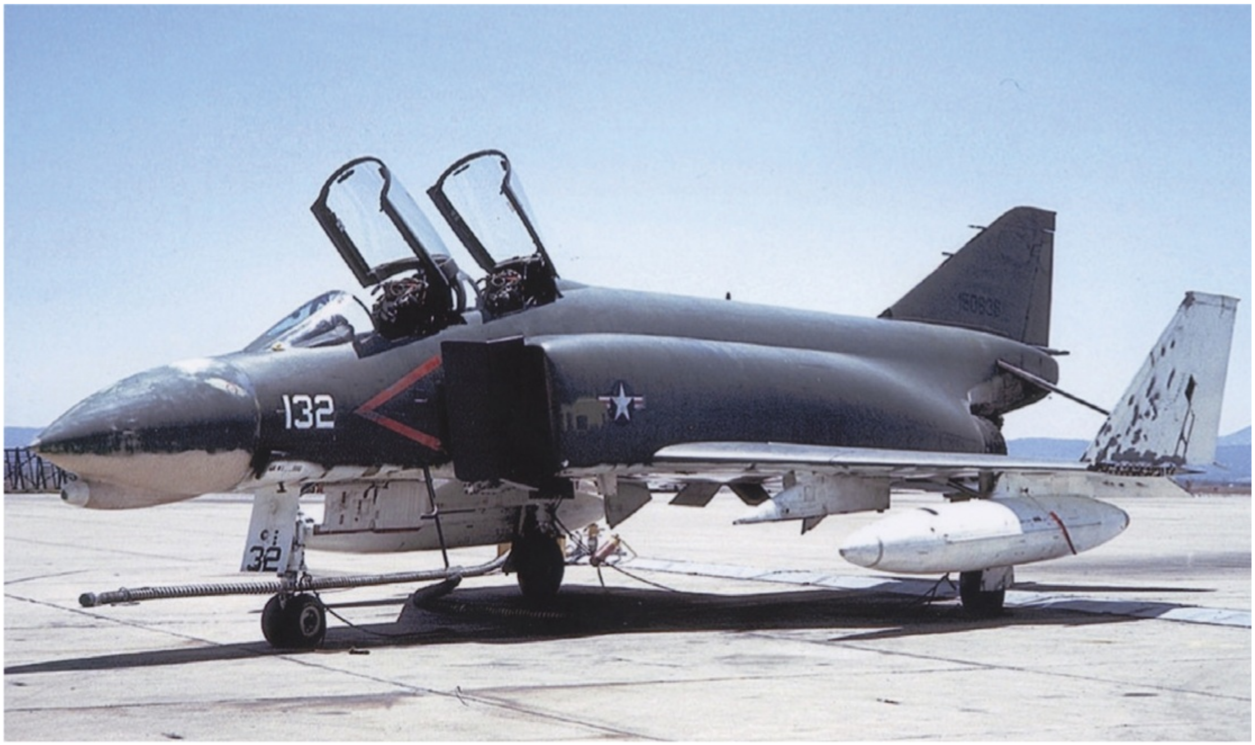
The system also allowed for 'hands-off' automatic carrier landings using the vessel's AN/SPN-10 radar, tracking the aircraft via a small, retractable radar reflector dish extending below its nose and an AN/USC-2 data-link. A further refinement was the automatic approach power compensator, or 'auto-throttle', which measured the aircraft's angle of attack on approach to the carrier and made small, instantaneous throttle corrections to keep the F-4 lined up 'on the ball'. The AN/ASW-13 (later, RCA AN/ASW-21) system was installed in F-4A BuNo 148254, although at the cost of tankage space for 600 lbs of fuel. In 1963 12 production line F-4Bs were modified to the revised standard.



VF-213's F-4G (F-4B-14-MC) BuNo 150484, in experimental camouflage, taxies towards CVA-63's bow catapults, with BuNo 150642 moving into position behind it. Both jets were re-designated as F-4Bs in October 1966. VF-213's ten F-4Gs were supplemented by two F-4Bs, one of which (BuNo 152257) was hit by AAA at low altitude while trying to locate a downed O-1 Bird Dog pilot in Laos. Other CVW-11 aircraft types received variations on the camouflage, and a VF-161 post-combat report included the comment that camouflaged A-4s were hard to tell apart from green MiG-17s in a melee over the target (*McDonnell Douglas*)

These aircraft undertook auto-throttle tests onboard *Constellation* in early

December 1963, and on 19 February 1964 Cdr Ken Stecker, CO of VF-96, and his RIO Lt Charles Webster III made the first data-link-controlled AIM-7 Sparrow launch at NAS Point Mugu. All Stecker had to do was select which missile to fire, while Webster set up the initial radar interception and a Q-2C target drone was shot down. In the operational scenario of Southeast Asia things would not be so straightforward.



F-4G BuNo 150636 was absorbed into VF-121's massive F-4 training fleet in July 1966 before serving out its final years with VMFA-323 until 4 October 1971, when it was lost after ingesting airborne target debris during a practice missile shoot against an MQM-74 drone. Seven F-4Gs eventually passed through the F-4N 'Beeline' conversion process and two (BuNos 150489 and 150492) survived fleet service to be assigned to the QF-4N target drone conversion programme (*Duane Kasulka*)

Ten of the data-link F-4Bs were then transferred to VF-96 in 1963, and from there to VF-213 'Black Lions' in February 1964, replacing that squadron's F3H Demons. In April they were officially re-designated F-4Gs. VF-213 was briefly designated VF-116 in 1964 for service with CVW-11 and the aircraft were marked accordingly, but the VF-213 nameplate was re-established in September of that same year. For their combat cruise onboard CVA-63 from October 1965, half of CVW-11's squadrons were involved in an experiment using a USAF-style tactical camouflage scheme as the MiG threat was thought to be increasing. The F-4Gs were flown to Clark AFB, in the Philippines, where the USAF's spray shop applied a rubberised dark green paint to their upper surfaces, although some were left with highly visible white radomes. ‘Black Lion’ pilot Lt John Nash participated in the three-week paint-shop visit, and he was unimpressed with the subsequent results;

‘I’m not sure it did any good as we weren’t in a real air war over there. The paint was only effective when you were looking down on the airplanes over the jungle. Visibility of the aircraft on deck in night operations wasn’t a particular problem as the deck was kept totally dark in those days and you couldn’t see anything anyway. They could have painted them black.’

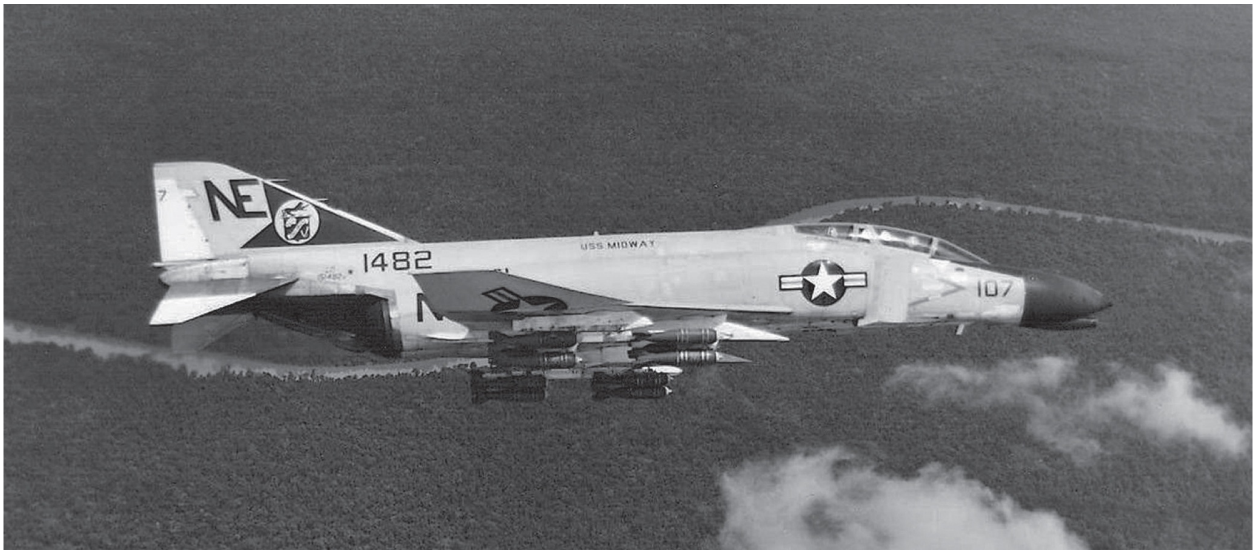
The US Navy was equally dubious about the results, and the camouflage project was discontinued in mid-1966. Although it possibly rendered the aircraft less detectable to MiGs flying above them, it also made them more visible to AAA gunners, who downed a higher number of the camouflaged aircraft than those with the normal finish. The F-4G’s advanced equipment was also somewhat redundant in combat, with data-link being rarely used during the cruise partly through its unreliability – the G-model’s service debut took place before solid-state electronics had started to feature in combat aircraft. Furthermore, there were few ships in TF 77 equipped to cope with the data-link process. However, the auto-throttle was popular with pilots who were prepared to trust it, and a one-way version of the data-link system – AN/ASW-25A – was built into the F-4J and installed in surviving F-4Bs.

At the end of the 1965-66 cruise, during which BuNo 150645 ‘Black Lion 111’ was lost while making a rocket attack on cargo-carrying junks on 28 April 1966 (pilot Lt R A Schiltz and RIO Lt(jg) D C Lewis were recovered), the F-4Gs were restored to F-4B standard and redistributed within the fleet.

CHAPTER FOUR

TOOLS AND TACTICS

Of all the difficulties faced by F-4 crews in combat, the disparity between the performance of their missiles under ideal, manufacturers' test conditions and the results experienced in actual aerial engagements were the most consistently frustrating. The problems, like most of the perceived shortcomings of the F-4 in its wartime roles, derived largely from the changes in those roles compared with the customer's original requirements. In its 1958 interceptor/fleet defence capacity the Phantom II's primary AIM-7D and back-up AIM-9B missile complement was ideal for the head-on, beyond visual range encounters with non-manoeuvring aircraft targets that were anticipated. On the few occasions where these conditions occurred in Vietnam, for example the MiG kills by the VF-21 and VF-151 crews in June and October 1965, the armament performed very much as prescribed.



Ordnance supply lines were hard pressed to keep up with the burgeoning wartime demands for all kinds of weapons in the mid-1960s – estimated at 50,000 tons per month during the summer of 1966 – resulting in some very old-stock bombs appearing beneath US warplanes (as seen on this VF-21 jet), rather than the preferred low-drag Mk-series weapons (*US Navy*)

These successes were a graphic demonstration of one of the F-4's main advantages over its opponents, but in the majority of MiG encounters very different outcomes were evident, and the two missiles quickly gained an unenviable reputation for unreliability that was never entirely dispelled by war's end. US Navy fighters' overall kill-to-loss ratio of 2.42-to-1 between 1965 and 1970 was much lower than the results achieved by carrier-based aircraft in previous conflicts, and it prompted concerns about the viability of the sophisticated missiles of US fighters compared with the basic gun armament of their adversaries.

VF-142's 'Dakota 213' (F-4B-16-MC BuNo 151415) returns to *Constellation* from a 14 August 1967 CAP. Landing gear was normally lowered ten miles from the carrier, with flaps down at 195 knots and 1200 ft altitude and tailhook extended at 800 ft. At about 1.5 miles, the pilot intercepted the four-degree glide slope to landing, centring the 'meatball' of the carrier's landing light system at an altitude of around 600 ft and descending to 300 ft half a mile out. The 'meatball' light's wide beam and the short extent of the deck runway lights could give the impression that the aircraft was flying too high, so pilots had to rely on Final Control line-up instructions from the Landing Signals Officer. All being well, the F-4 then made very solid contact with the deck, snagging the third arresting wire (*R L Lawson/US Navy*)

The difficulty of employing the missile systems in close combat became apparent from the first MiG encounter in April 1965, resulting in the loss of Lt(jg) Murphy and Ens Fegan. VF-21's clash with VPAF MiG-17s two months later also showed up weaponry issues with the Phantom II when engaging nimble communist fighters. Two 'Freelancers' F-4Bs on a BARCAP near Phuc Yen on 4 June were confronted by two sections of MiG-17s, and Lt David Tozier armed his AIM-7s as he followed one pair in a hard turn. The MiGs suddenly levelled out at short range, but they had disappeared into cloud before Tozier could make the difficult switching change from AIM-7s to AIM-9s. Lt Cdr Gene Fitzsimmons moved in behind the second MiG section and attempted to fire an AIM-7 from a favourable position. The missile failed to respond and the opportunity was lost before Fitzsimmons could select another AIM-7.

These early combat experiences with the missiles prompted the US Navy's VX-4 operational testing squadron to re-evaluate the weapons in realistic air combat situations. One result was an improvement in the AIM-7's proximity fuse, as the original had been designed to impact and penetrate a bomber-type aircraft before exploding. This was far more difficult against small, manoeuvring aircraft, even with the AIM-7D's limited proximity fuse.

Release or fusing faults could also have unfortunate consequences for the launcher F-4 when the missile exploded almost immediately after leaving the aeroplane, as VF-142's Lt Cdr Eugene 'Geno' Lund and Lt(jg) Jim 'Biff' Borst discovered during an afternoon MiGCAP sortie for a raid on Thanh Hoa bridge in F-4B BuNo 150629 (formerly an F-4G) 'Dakota 204' on 30 October 1967. Their 'Harbormaster' ship-borne radar controller vectored them towards a bogie that was actually a flight of four MiG-17s at an altitude of 18,000 ft. With a VID made at about four miles, they fired an AIM-7E that, as Lund recalled, 'commenced to guide absolutely beautifully and impacted on the No 2 MiG. It hit just aft of the cockpit and he blew up and entered a flat spin'. The Phantom IIs then entered a fight with the other remaining MiG-17s, and Borst got a boresight lock-on to two other VPAF jets at a range of three miles. Lund continued;

'I fired again. The missile left the launcher and about 100-200 ft from the airplane it exploded and broke up into all kinds of pieces. I felt a jarring sensation in the airplane – I didn't know if it was jet-wash. Apparently the right engine had stalled and I didn't know it. From that time on the airplane was sluggish. I'd gone into full burner on both engines and performed another high "yo-yo" manoeuvre to get back on the MiG. I zipped past one, canopy-to-canopy, at about 20 ft, and this one I determined to be camouflaged olive drab. I didn't get a shot at him because he was head-on.

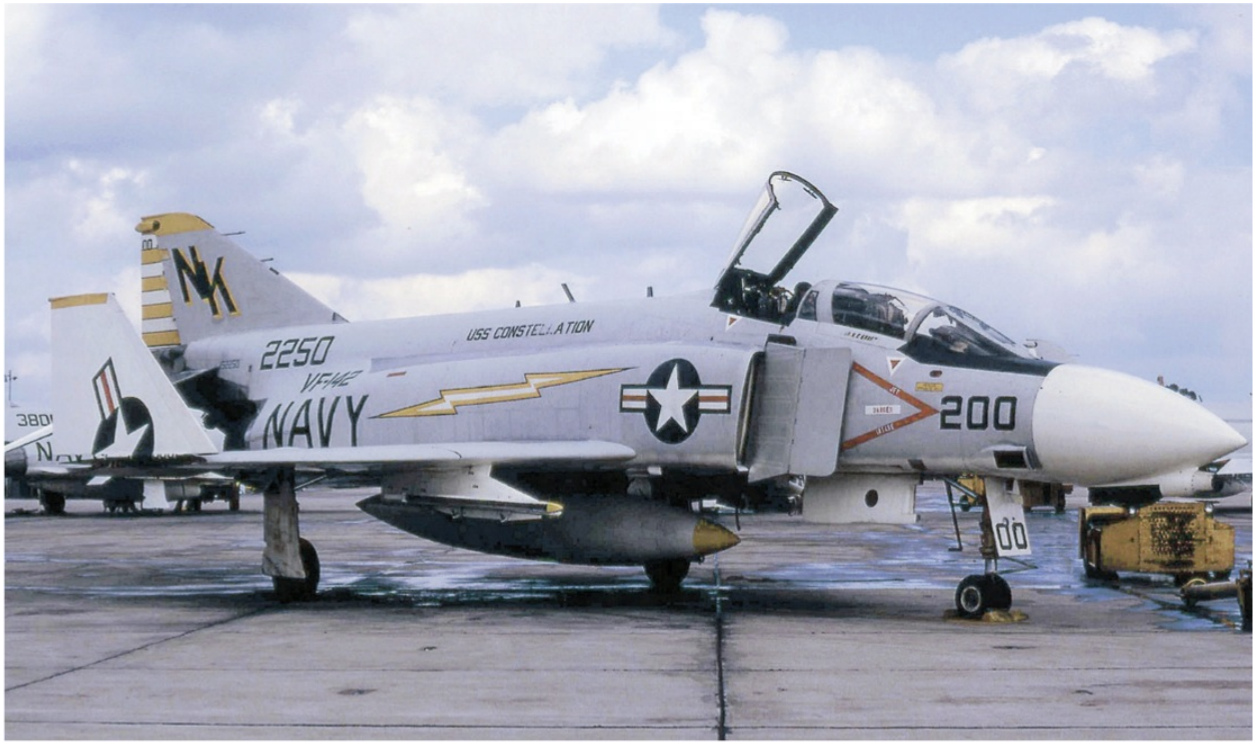
F-4B-10-MC ‘Dakota 214’ (BuNo 149445) takes off on a CAP mission from *Constellation*, showing evidence of the constant corrosion control required under the punishing conditions of carrier-borne operations. In one of the most bizarre, unpredictable occurrences aboard CVA-64, VF-143 F-4B BuNo 149443 was accelerating to flying speed down the flightdeck on 16 September 1968 when a large section of the main cockpit instrument panel came loose and ‘attacked’ the pilot, Lt Cdr W R Lambertson. Seriously distracted, he stalled the aircraft into the sea and both he and RIO Lt(jg) T L McPherson were forced to eject. They were quickly rescued by the plane-guard SAR helicopter (*US Navy*)

‘I almost got a shot on one more run-through [of the engagement area]. I picked him up again dead ahead at about three miles, but I had to turn through 80 degrees to get on his tail. I was coming down on him but I couldn’t get a “growl” on my Sidewinder because of the angle. It was a good Sidewinder but we couldn’t get a lock-up on him. We met a couple more times, and that’s when I looked down and figured out why the airplane was so sluggish. The right engine was at idle even though the throttle was at full afterburner. I figured I had a stall so I pulled the throttle back to idle and started moving it up to 70 per cent, but I got a heavy rumble in the airplane and the rpm dropped off so I thought I had a fire in the right engine. Utility hydraulic pressure was down to about 1200 lbs so I realised I had better get out of there.’

Their wingman F-4B (flown by Lt(jg)s Ron Ludlow and Bruce Hardison) was over Kep air base at this time. The jet was suffering from a radar problem that prevented them from using AIM-7s against the MiGs, and they passed on the chance of a Sidewinder kill in favour of escorting Lund and Borst's damaged Phantom II. Hardison saw the three MiGs heading for Noi Bai air base and turned his attention to 'Dakota 204', reporting that it had leaking hydraulic fluid all over its underside and holes near the forward Sparrow well where an AIM-7 had exploded after being ejected at the wrong angle. Missile debris had also entered the right engine intake, causing the compressor damage and stall. Lund's instruments indicated a complete utility hydraulic failure, which, among many other functions, prevented him from extending the refuelling probe to take on some much-needed fuel.

He decided that his 'single-engined dogfighter' could make the 80 miles back to *Constellation* at 300 knots. However, on approach to the landing circuit Lund repeatedly attempted to extend the undercarriage but the hydraulic loss made this impossible, even with the pneumatic back-up extension system. With their fuel down to 600 lbs the crew had to eject a mile short of the carrier.

Although a Sparrow could destroy a target at a range of 12 miles, VID was necessary over Vietnam, partly because the airspace was usually shared with USAF aircraft despite the route package demarcations. The possibility of 'blue-on-blue' missile hits sometimes became a reality, and these incidents were not confined to the AIM-7. Lt(jg) Mark Gartley and Lt Bill Mayhew, flying VF-142 F-4B BuNo 151404 on a 17 August 1968 CAP (their 30th mission), had 'their first MiG engagement for some time' when MiG-21s challenged them near Vinh. Bill Mayhew recalled;



The 'Ghostriders" CAG aircraft, F-4B-22-MC BuNo 152250, at NAS Miramar after *Constellation*'s 1968-69 combat cruise. This aircraft had previously flown with the squadron as NK 204 in 1965-66, and it returned to CVA-64 in August 1969 for yet another visit to the Gulf of Tonkin. In 1967 F-4Bs of VF-142 and VF-143 onboard *Constellation* were the first to receive the Shoehorn Mod 3 ECM fit that included a single fin-cap fairing for the aft-facing AN/ALQ-51/100 receive antenna and the original Shoehorn Mod 2 'hooked' fairing under the radome, which instead housed AN/APR-25 and AN/ALQ-51 forward hemisphere antennas (*Author's collection*)

'We pickled off the centreline tank, got behind them into a firing position and couldn't get the [AIM-9] missile to launch. One MiG went into afterburner as it turned away, and it would have made a great target. We saw another "MiG" coming at us in the other direction with a smoke trail behind it.'

It was later established that the 'MiG' was actually his flight leader's Phantom II, and the AIM-9D fired from it passed by its MiG target and hit the fellow 'Ghostrider' F-4B in the tail, consigning Gartley and Mayhew to a Hanoi prison.

Missile unreliability became a major issue in all three US services and the divergence between manufacturers' test results and combat outcomes eventually resulted in a full Naval Air Systems Command enquiry in the second half of 1968 led by Capt Frank 'Whip' Ault. Published in January 1969, the report reviewed the use of the AIM-7 and AIM-9 and noted that of 330 AIM-7s fired by US Navy and USAF F-4s up to the end of *Rolling Thunder*, only 27 had resulted in air-to-air kills. The overall kill rate in Vietnam was 15 per cent for the AIM-9 and only eight per cent for the AIM-7. The situation had been particularly bad in the first half of

1968, with only two kills from 30 missiles launches.

In the last F-4 versus MiG engagement of *Rolling Thunder*, on 25 August 1968, two VF-143 F-4Bs were vectored onto a pair of MiG-21s. In the course of the subsequent engagement ten missiles (seven AIM-9Ds and three AIM-7Es) were fired without any damage being inflicted on the MiGs, even though a Sidewinder exploded a few feet behind one of them. Luckily, the two 'Atolls' fired back at the F-4Bs also failed to guide correctly.

Ault commented succinctly on the whole missile scenario, observing that 'Numerous missiles fired in combat have missed because they were fired out of envelope at low altitude against a relatively small manoeuvring target by a fighter with a missile system computer mechanised for a high-altitude, non-manoeuvring bomber'. Pointing to a need for improved training, the report concluded that 'Despite a renewed emphasis on ACM training since the commencement of hostilities in Southeast Asia, much of this effort has been wasted because it did not stress one of the key elements of the problem – missile envelope recognition/identification at low altitude. Since the missile control system computers are not properly mechanised for a low-altitude manoeuvring target, firing envelope recognition is largely by "eyeball and intuition"'. Revisions in training and the Topgun programme, recommended by Ault, would bring big changes in that situation for the US Navy and USAF from 1970 onwards.

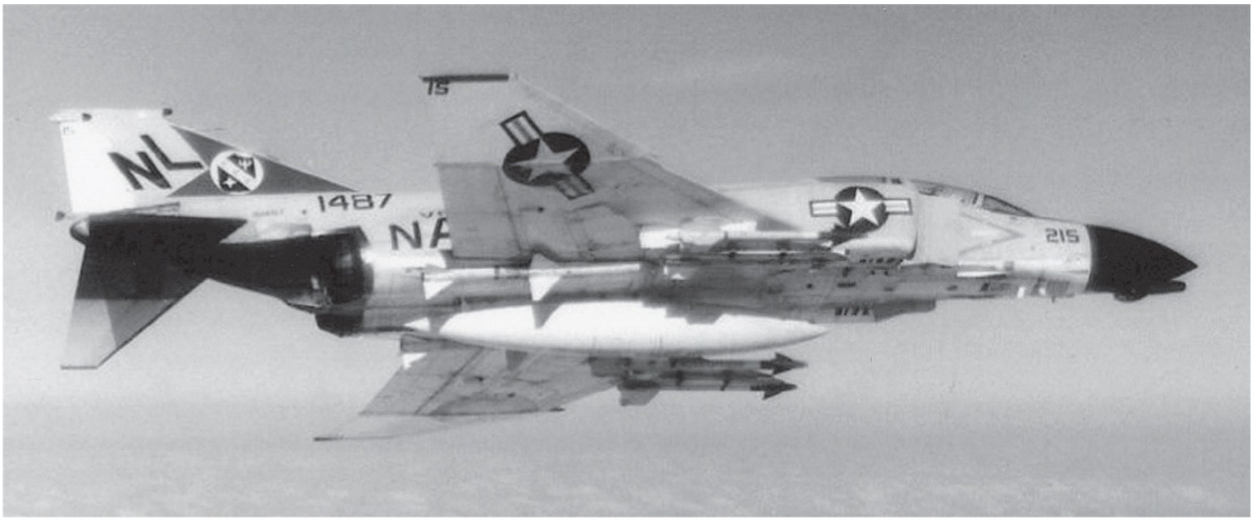
Ault's 450-page report, researched with five teams of investigators, acknowledged the complexity of setting up an AIM-7 launch within the correct parameters of range, closing speed and target movement, noting that these could vary with altitude and air temperature. This process was satisfactory when the target was a single, non-manoeuvring aircraft at the correct 12-mile radar range and unaware of the missile's approach. In the confusion of close combat with multiple threats against a background of SAMs, AAA and other compelling distractions missiles were often fired outside parameters or without the requisite minimum five seconds for the launch procedure. The need for the F-4 RIO to keep a radar lock on to the target throughout the missile's flight was also an unrealistic demand in many cases and, either the target or the F-4 often exceeded 3g in manoeuvring, thereby breaking the lock.

Ault also found a general lack of understanding of the complexity of the missiles and the need to look after them rather more like aircraft than bombs. The sensitive AIM-7s responded badly to being left on the F-4s for several punishing launch and recovery cycles without the frequent maintenance checks needed to assess the effects of moist, salt air, temperature changes and the stress of repeated carrier landings. He noted that there was ‘no adequate shipboard handling and loading equipment for Sparrow missiles. Missile ground handling equipment at Naval Air Stations features many locally fabricated or modified equipments which subject missiles to damage’. Evaluation of the Aero 21AX loading adapter and Aero 67A loader was recommended. He also advocated establishing forward area support and repair facilities for the missile at Subic Bay, observing that it took at least 270 days to process a defective weapon through the existing repair system and return it to service on a carrier. The shortage of well-trained ordnance men for F-4 squadrons during the *Rolling Thunder* period was another factor that took time to resolve.

The report acknowledged that the US Navy had to be ‘more specific in defining systems performance requirements’ for missiles to match operational needs, and was clear that much better training and supply of parts was needed in the maintenance of missiles and radar systems like the AN/AWG-10. Ault drew attention to the re-work programme that was supposed to update systems and replace components systematically, saying that it was in practice just a repair programme and noting, for example, that ‘Until July 1968 the Aero 1A missile control system in the F-4B was not being re-worked at all, yet analysis has repeatedly identified the missile control system as the key performer in a Sparrow shoot’.

In practice, it was often rare for both F-4Bs in a flight section to have their radars fully operational. Ault also recommended that F-4s should not be declared ‘up’ for a mission unless they had a fully ‘up’ missile control system, even if their mission was an air-to-ground one. It was common practice to launch aircraft with some systems, particularly radar, inoperative simply because (unlike the USAF, which had similar problems) the small numbers of available F-4s often meant that there were no spares to fill the slots. Crews hoped to rely on their leader or wingman for radar guidance if necessary.

Capt Ault’s quest for greater reliability extended to quality control by manufacturers like Raytheon and Westinghouse to improve mean time between failures (as low as five hours for the AN/AWG-10 at the time). ‘Dogfight’ modifications to the AIM-7E, which would give pilots a more manoeuvrable, re-worked AIM-7E-2 and AIM-7F after 1968, were to be matched by a requirement for a more reliable AIM-9D SEAM (Sidewinder expanded acquisition mode) that could be fired from a wider angle rather than the narrow, stern attack envelope of the AIM-9B.



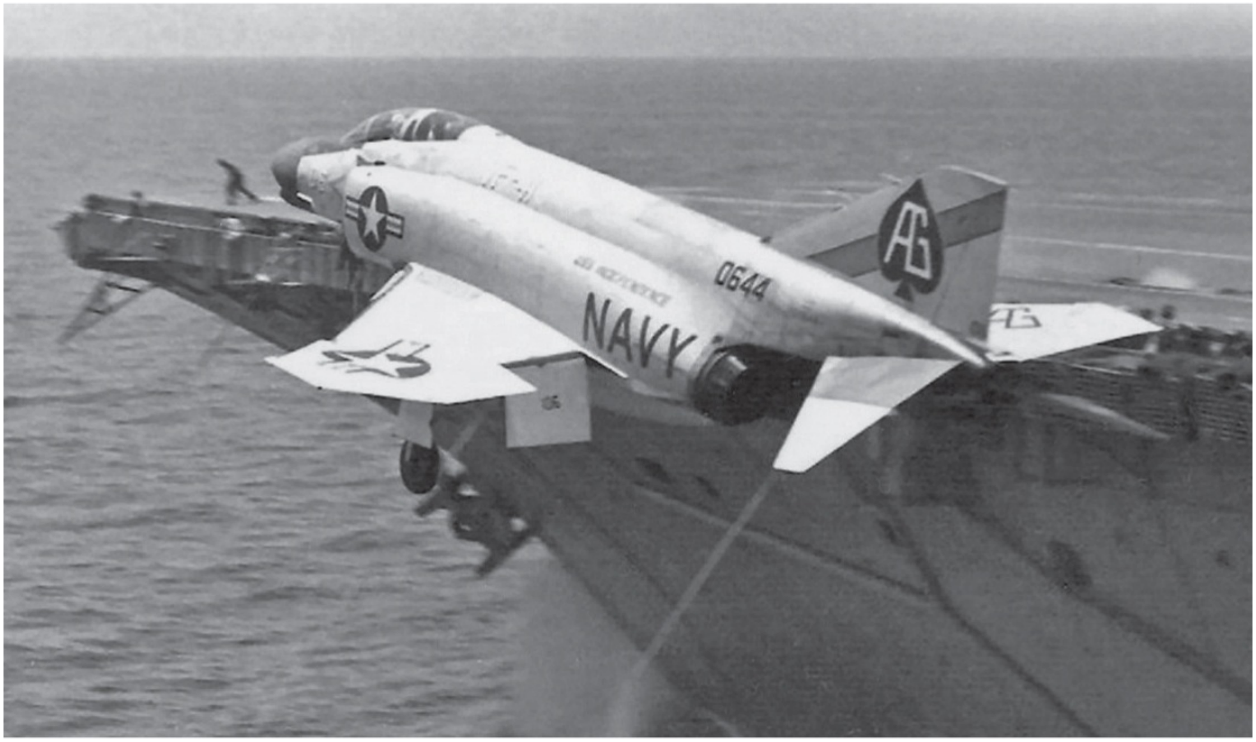
Capt Frank Ault, reporting on the combat performance of US missile systems, commented tellingly that 'US fighter pilots have been required to fight a "heads-up" engagement in Southeast Asia with a "heads-down" system. This is particularly true for the F-4'. The AIM-9 offered a 'heads-up' alternative to the radar-guided Sparrow III for closer engagements. AIM-7Es and AIM-9Ds are the CAP load-out for this VF-161 Chargers F-4B-19-MC (*US Navy*)

The simpler AIM-9 required far less maintenance than the AIM-7, with a portable tester session every 100 hours of activated time and a quick pre-flight test in which a flashlight was shone into its seeker head to check that it gave an aural signal. Ault stated categorically that 'Sidewinder's performance is superior to Sparrow's because of its less complex design, better inherent design reliability and lesser impact of subsystems (e.g. missile control system) interfaces'. At the time, the AIM-9 was becoming some F-4 pilots' weapon of choice as they set up their missiles en route to the target. However, Sidewinder could not perform the Sparrow's long-range, head-on interception role, and the AIM-7 was still regarded as the F-4's primary weapon, used for seven of the thirteen MiG kills attained between 1965 and 1968.

The experience of Lt Guy Freeborn typified a bad day for the F-4B's missile system. In a BARCAP flight for a big Alpha strike on the Phu Ly transportation area on 10 August 1967, he was flying F-4B BuNo 152247 'Dakota 202' with Lt(jg) Bob Elliott. 'Dakota 210' was BuNo 150431, with Lt Cdrs Bob Davis and Gayle 'Swede' Elie aboard. As Freeborn explained, 'My choice of missile for close-in fighting was always Sidewinder. Reliability of missiles was a major issue then. The engagement was planned by us based on the environment – i.e. positive radar or radio control and thin cloud layers at 22,000 ft'. The BARCAP flyers planned to catch MiGs by staying just under the cloud layer, knowing that MiGs tended to dive through the clouds under GCI control to ambush the strikers. 'We were very familiar with the MiG-21's capabilities and tactics. We just hadn't seen many. They were mainly into "hit the strike elements and run for home", with not much dogfight capability'. It was a successful ruse that gave TF 77's Phantom II force its first MiG-21 kills.

The 'Dakotas' were warned of two MiGs approaching from astern at 400 mph, and they turned back to swing round from behind them as they dropped through the cloud. They soon saw a pair of silver MiG-21s and positioned themselves at their rear, in afterburner, as they set up their missile switches. Elliott's radar was showing only interference, but the two Phantom IIs were soon in position for textbook missile shots from the MiG-21s' 'six o'clock' position. Lt Cdr Davis selected AIM-7s but the missiles would not launch, and it was later established that the rear left Sparrow well (station No 3) lacked the ejector cartridge to kick the missile clear on launching. He also neglected to release the trigger and fire again, which would have selected and fired the next Sparrow from the parallel station No 7. When Davis switched to HEAT (Sidewinders), the first AIM-9D fired off ballistically without guiding and the second exploded near the MiGs, serving only to alert them so that they made a sharp left turn.

Lt Freeborn then released an AIM-9 that exploded near enough to draw some smoke or fuel vapour from the left-hand MiG-21. The F-4 pilots pulled up into a high yo-yo to avoid overshooting and Lt Cdr Davis then descended behind Freeborn's target MiG and fired two more AIM-9Ds, one of which blew off the rear fuselage of the VPAF fighter. Annoyed at this unexpected intervention, Freeborn turned his attention to the second MiG and prepared another AIM-9D, but it refused to launch. He tried again and his next Sidewinder flew up the jet's tailpipe, causing a fatal explosion. In their brief engagement the two F-4B pilots had fired nine missiles and only three had performed satisfactorily. They were by no means the only crews to be frustrated by what they saw as their temperamental weaponry, but also to be impressed by its destructive power when it worked as advertised.

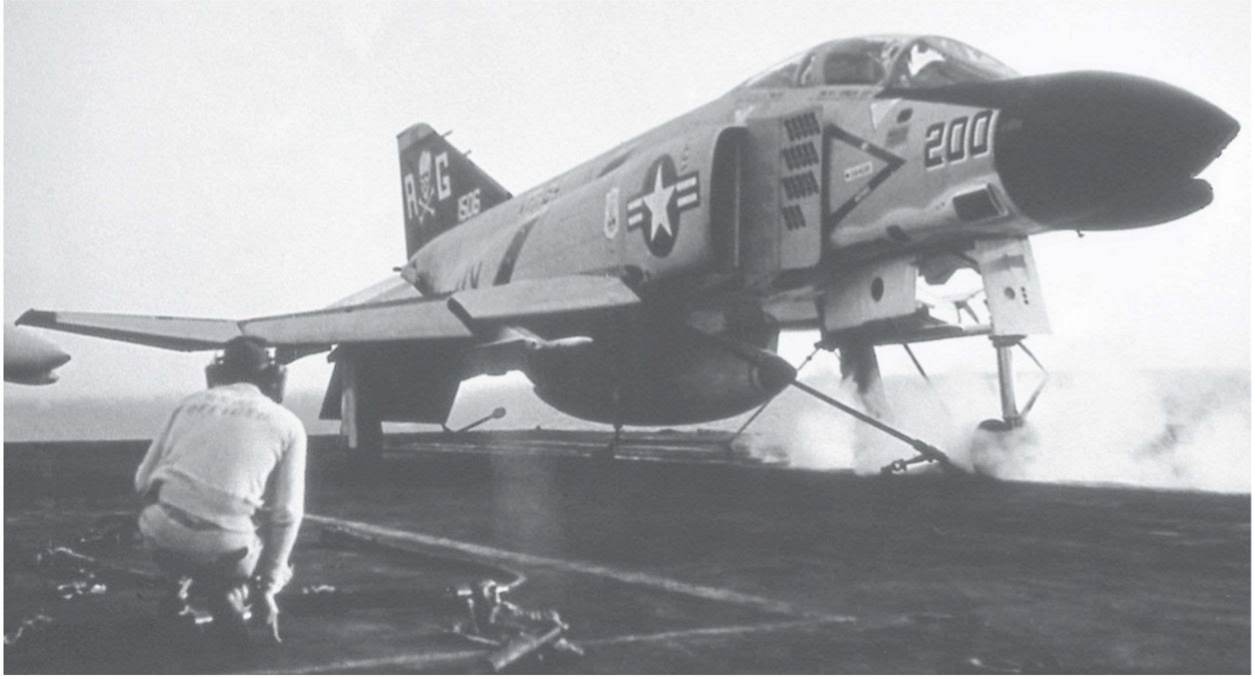


This view of VF-41's F-4B-14-MC BuNo 150644 leaving the waist 'cat' of *Independence* was taken from the plane-guard helicopter. During the unit's seven-month cruise in 1965 its Naval Aviators flew the full range of CAP, flak suppression and 'trails' interdiction missions by day and night. The standard practice was to rotate F-4 crews out of the Vietnam circuit after two combat tours, although some returned for a third. On average days most crews were scheduled for up to two flights, but during busy periods it was not unusual to fly three times and then man a deck alert flight too (*US Navy*)

SIXTH FLEET

The unexpectedly severe demands of the war soon brought about a shortage of aircraft carriers within the Pacific Fleet, with a lengthy five-year-long refit to the 20-year-old *Midway* (commencing in February 1966) exacerbating the problem. The length of on-line periods and deployments had to be increased to cover the gaps – CVA-41's sister-ship *Coral Sea* had spent 331 days at sea by the time it returned to port in November 1965. It was therefore necessary to borrow carriers from the Atlantic Fleet, beginning in May 1965 with *Independence* and its F-4Bs from VF-41 'Black Aces' and VF-84 'Jolly Rogers' – the first Atlantic Fleet Phantom II squadrons to deploy to the war zone.

As one of the first F-4 units to explore the jet's conventional weapons capability, the 'Black Aces' used their time in-theatre to evolve tactics for night bombing and road reconnaissance by the light of flares. Their experience was of great value to other Atlantic squadrons who followed them to war. As Capt John Nash pointed out, when bombing from an F-4B, 'everything had to be perfect – airspeed, dive angle and g at release. When you get AAA in your windscreen your technique starts to degenerate'.



Photographed on 7 July 1965, just seconds away from being launched off CVA-62's flightdeck, VF-84's CAG F-4B BuNo 151506 already has 18 mission markings in place to accompany the 'Tonkin Gulf Yacht Club' patch on its flank after only eight days of action during its first line period with TF 77. The increasingly heavy mission schedules soon left little time for trophy mark-ups of this kind. Otherwise, many F-4s would soon have resembled wartime B-17 Flying Fortresses with massive 'scoreboards' (*Cdr J Carlton/US Navy*)

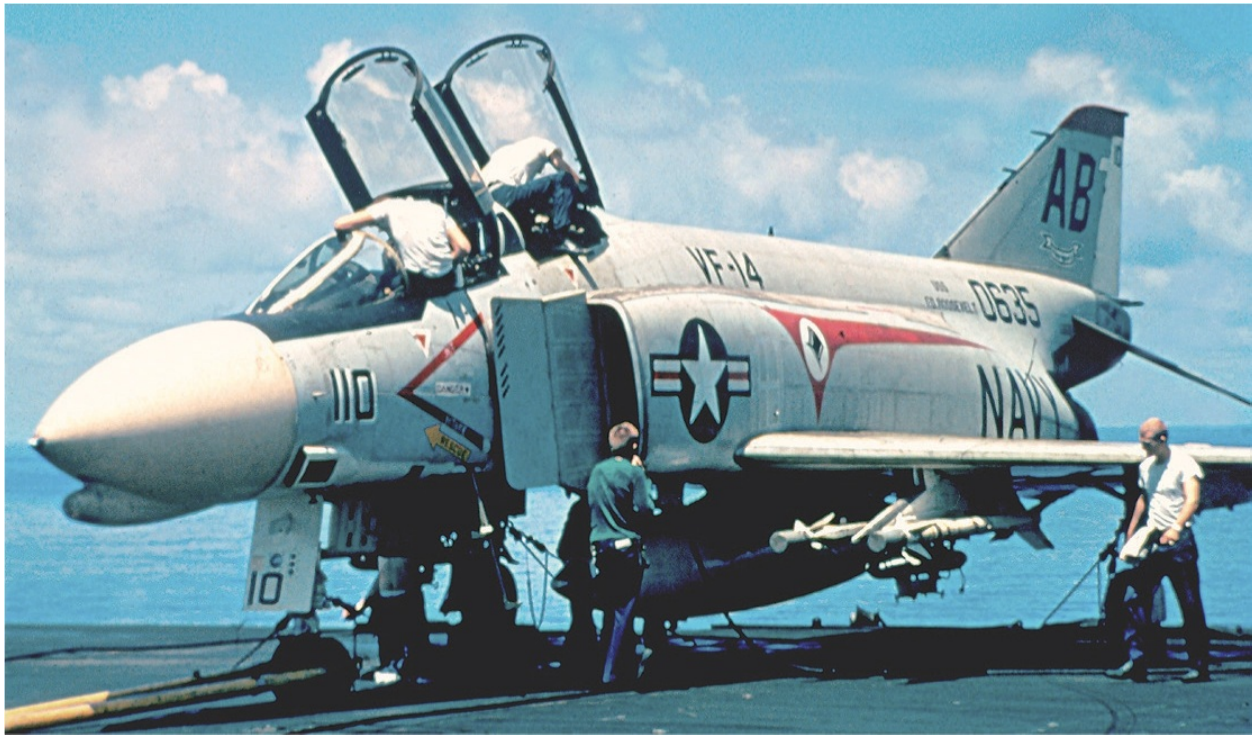
CAP-configured VF-41 F-4B-14-MC BuNo 150491 accelerates away from CVA-62 as a group of bombed-up A-4Es from VA-72 and VA-86 prepare to be launched from the vessel's bow catapults in 1965 (*US Navy*)

During its 100-day deployment, VF-41, led by Cdr Robert Gormley, continued the attacks on coastal radar sites with Mk 82s and Zunis. Crews quickly became aware of the ever-increasing strength of the enemy's defences. The technique of barrage fire became common, ranging from groups of soldiers lying on their backs and firing at an area of sky that was about to contain passing aircraft to 23 mm automatic AAA filling a 'box' of sky with pre-aimed explosions.

The fierce AAA opposition cost *Independence* three F-4Bs during a 17 October 1965 Alpha strike on the Thai Nguyen bridge near Hanoi. A VF-84 flak suppressor (BuNo 151515) was hit in the cockpit at 2000 ft, killing Lt Cdr Stan Olmstead and forcing his RIO, Lt(jg) Porter Halyburton, to eject. Another 'Jolly Rogers' aircraft (BuNo 151494) was hit as the strike left the target, starting a major engine fire. RIO Lt(jg) Rodney Knutson, seriously injured during ejection, found himself under fire from North Vietnamese troops when he landed by parachute. He fired back, killing two soldiers, before being shot and further wounded at point blank range. Both he and pilot Ens Ralph Gaither were captured. Finally, VF-41 F-4B

BuNo 150631 was also hit during egress from the attack, killing its pilot, Lt Roderick Mayer, and leaving RIO Lt(jg) David Wheat to spend the rest of the war in captivity.

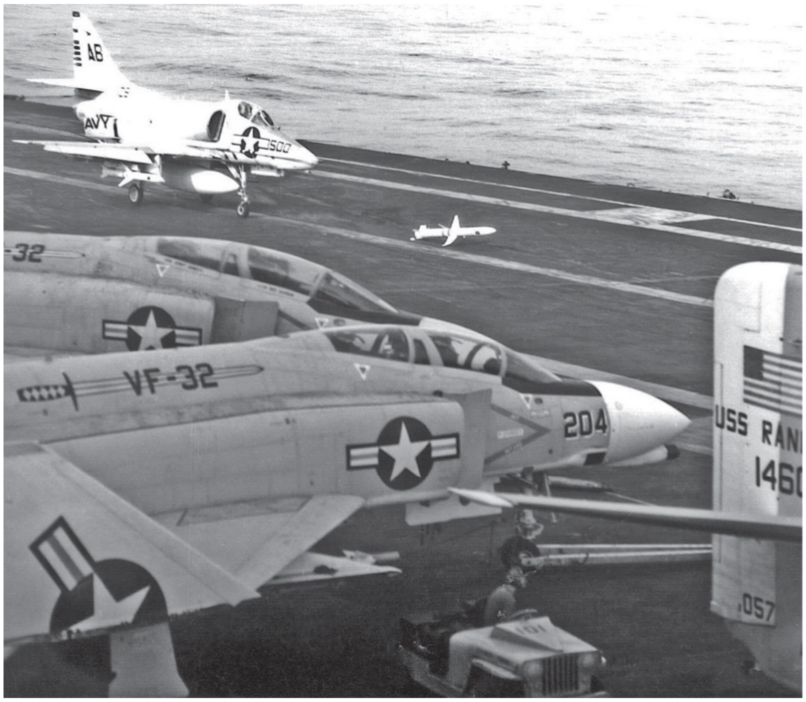
The experience of these squadrons was passed on to their fellow Atlantic Fleet units VF-14 'Tophatters' and VF-32 'Swordsmen' when they headed for battle with CVW-1 embarked in *Franklin D Roosevelt* in June 1966. Used to interception training, both squadrons were initially overloaded by the new emphasis on ground attack. They also had to adapt to the exacting demands of their 21-year-old carrier when operating their F-4Bs at combat weight. Fuel for recovery had to be reduced to 1900 lbs – enough for two landing attempts, but after that the remaining 1000 lbs was not enough for a diversion to Da Nang! VF-14 began combat as flak suppressors, but it was soon switched to strike bombing. For the latter mission the squadron's jets were loaded with four Mk 83s and four Mk 82s, together with an empty centreline fuel tank that was 'tanked' full soon after launch. The flak suppression role, which had seen the F-4Bs employing Mk 82s fitted with 'daisy cutter' 36-in fuse extenders in the bombs' noses to make them explode above ground, was passed to AGM-12C Bullpup-armed A-4Es from VA-12 and VA-72 instead.



Maintainers prepare VF-14 'Tophatters' F-4B-14-MC BuNo 150635 for what will be its ninth attack sortie in September 1966. VF-14 and VF-32 served with CVW-1, commanded by Cdr Wendell K Smith, arriving on station with TF 77 on 10 August 1966. The 'Tophatters" first combat sortie that day was manned by Lt Cy Strickler and

Lt(jg) Ted Scarboro, who escorted VA-72 'Blue Hawks' A-4C Skyhawks. BARCAPs and night bombing under flares followed within four days, with photo-escort missions for VFP-62 Det 42 RF-8G Crusaders added by 23 August, when the first SAM was encountered. The F-4Bs also took over many bombing missions from the overworked A-4Cs, expending loads of four Mk 82s and four Mk 83s on bridges, the rail network and troop targets (*PHC Neal Crowe/US Navy*)

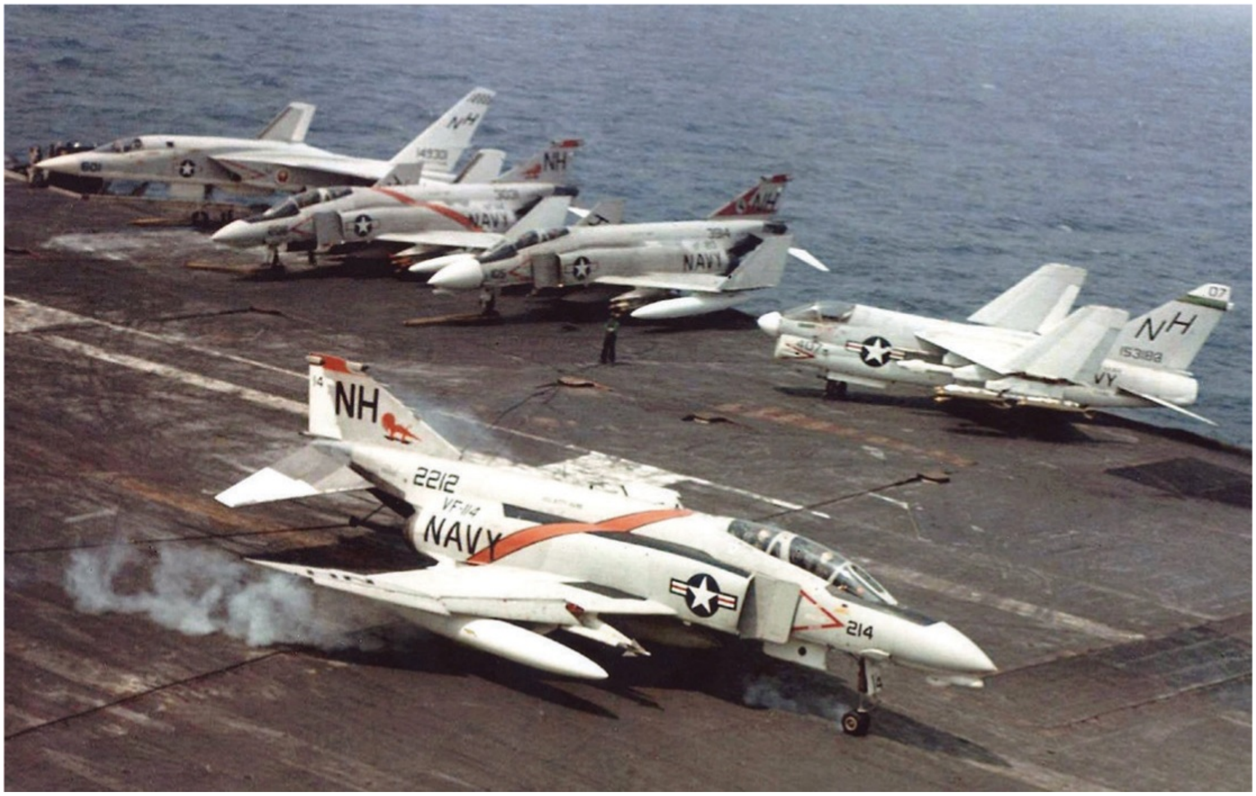
The 'Tophatters' Phantom IIs were also modified for loft bombing with conventional ordnance such as the Mk 83, using the techniques and AJB-3 bombing computer that were originally designed for a tactical nuclear weapon. Approach to the target was made at about 5000 ft and 500 knots, pulling up to release the bombs in a 15-degree climb and then turning away on a reciprocal course. Such an attack profile was briefly seen as a safer way of hitting AAA sites. The AN/APQ-72 radar was also refined to give clearer definition of small ground targets. Several trial loft-bombing sorties were flown but consistent accuracy was hard to achieve. VF-114 also tried loft bombing on a 27 December 1967 mission north of Vinh, Lt Cdr Leonard Lee and Lt(jg) Roger Burns, in F-4B BuNo 153005, approaching the target below a 1000 ft cloud base, ready to pull up and release their bombs. Their wingman was able to hit the target in this way, but Lee's aircraft vanished from the radar scan of the E-2A Hawkeye that was covering the attack. It was assumed that Lee had hit the ground while recovering from the loft manoeuvre in poor visibility.



An AGM-45A Shrike anti-radiation missile, shaken loose from a VA-72 'Blue Hawks' *Iron Hand* A-4E Skyhawk by the shock of deck landing, slides along *Franklin D Roosevelt*'s flightdeck in front of two VF-32 'Swordsmen' F-

4Bs. Two *Iron Hand* A-4Es preceded each Alpha strike to tackle SAM sites – targeting the latter was a skill that the US Navy developed well before the USAF evolved its own anti-SAM methods. VF-32 made one combat deployment, sustaining only one operational loss in 95 days on the line (*US Navy*)

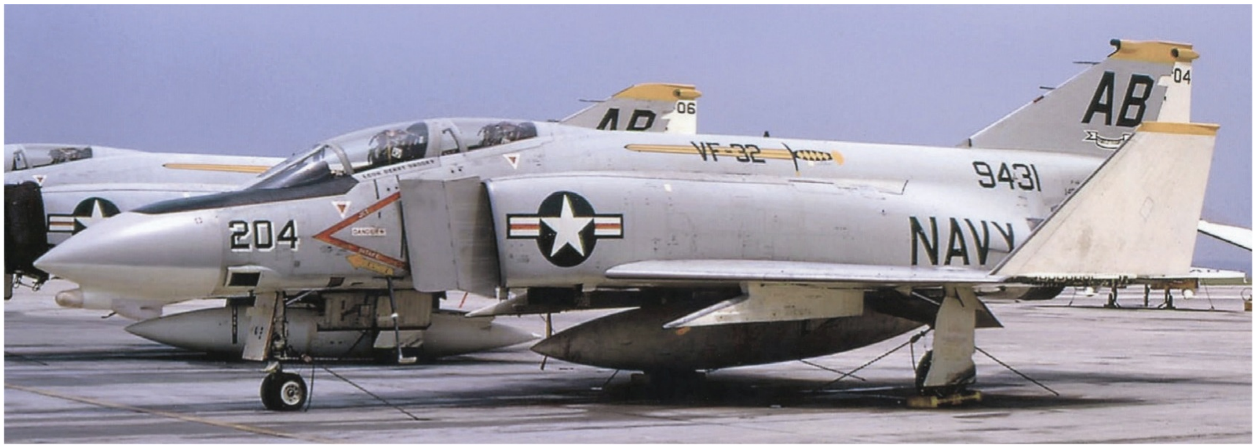
Aside from *Independence* and *Franklin D Roosevelt*, three other East Coast attack carriers – *America*, *Forrestal* and *Saratoga* – made combat cruises with TF 77, bringing the total number of carriers in the Gulf of Tonkin to five at times. Furthermore, in October 1965, the US Navy's only nuclear-powered carrier, *Enterprise*, was transferred to the West Coast from Naval Station Norfolk, Virginia, and it made six wartime cruises in all.



'Aardvarks' F-4B-20-MC BuNo 152212 thumps down onto *Kitty Hawk*'s flightdeck in January 1969, configured, like the two CVW-11 F-4Bs chained down behind it, with three external fuel tanks. Some recoveries were less straightforward. Lt Fritz Klumpp (with Lt(jg) J N Stineman as his RIO) of VF-114 experienced the F-4's vulnerable hydraulic systems after attacking a bridge in the Mu Gia Pass on 31 January 1966 – his 30th mission. Klumpp's hydraulics were badly damaged by ground fire but he managed to fly back to *Kitty Hawk* and commence a landing approach in F-4B 'Linfield 402' (BuNo 152233). The aircraft then began to roll uncontrollably. 'We made it to the water before being forced to eject', he recalled. 'I was back in the cockpit two days later, and had completed 106 more missions by the end of May 1966'. For its 1968-69 deployment CVA-63's A-4 Skyhawk contingent was replaced by the A-7A Corsair IIs of VA-37 and VA-105 (*R L Lawson/US Navy*)

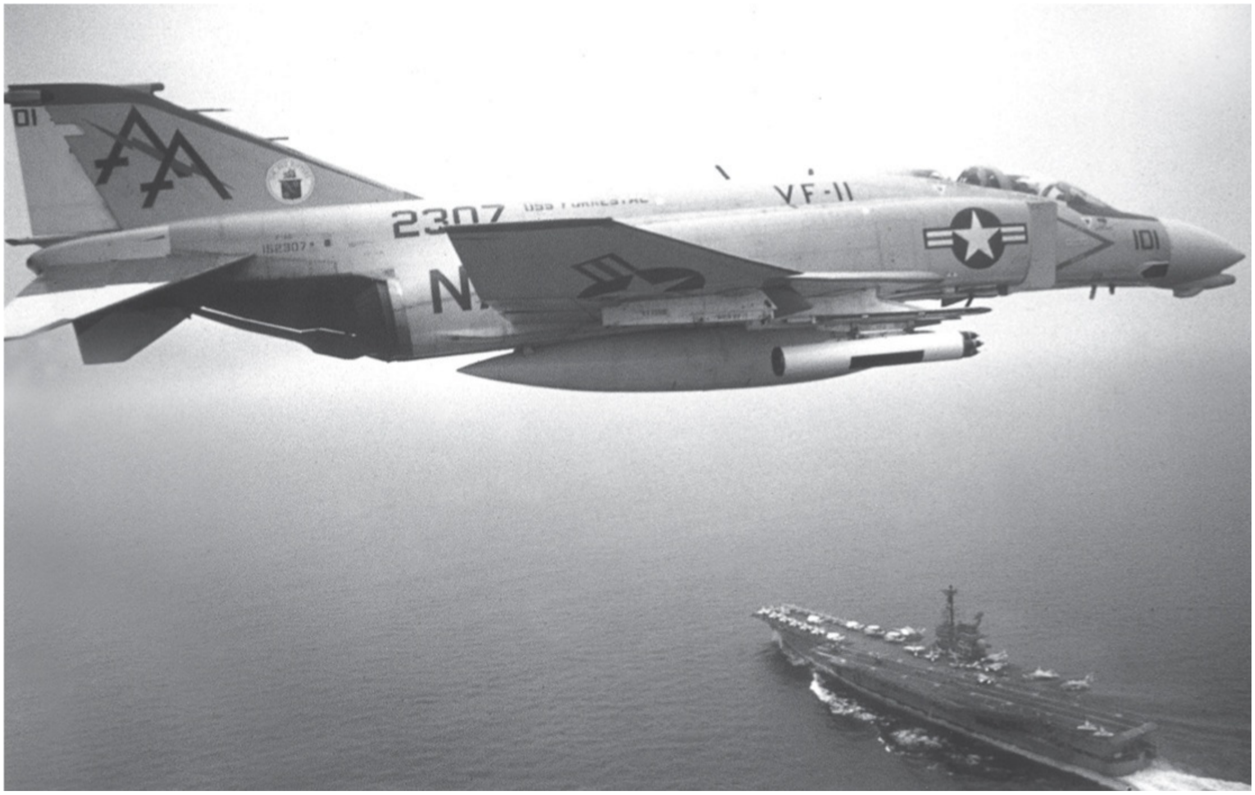
FORRESTAL **FIRE**

Fires on overcrowded aircraft carriers were every crew's nightmare. The first to hit TF 77 was started in a magnesium flare locker aboard *Oriskany* in October 1966, killing 25 pilots and 19 sailors and taking the carrier out of the war for nine months. Of all the lethal ordnance aboard carriers, the Zuni rocket was involved in the most disastrous onboard fires. One of these occurred aboard *Coral Sea* on 18 October 1967 when nine sailors were burned after a Zuni ignited during a test on deck. Crewmen near an F-8 Crusader onboard *Hancock* had also been badly burned when a Zuni misfired earlier that same year.



This VF-32 F-4B-10-MC was photographed at NAS Oceana in 1968 following the squadron's single wartime cruise with CVW-1 in 1966-67 onboard CVA-42, which included a period as the 'night' aircraft carrier. 'Rosie's' two F-4B squadrons attacked river barges, AAA sites and other targets of opportunity (*R Sullivan*)

However, nothing compared with the fire onboard *Forrestal* that almost destroyed the ship on 29 July 1967 – only its fifth day on the line in the Gulf of Tonkin. VF-11 F-4B BuNo 153061 AA 110 was one of three loaded with six LAU-10/A Zuni pods on TERs rather than the 2.75-in rockets that the pilots had expected. The aircraft had flown an 0700 hrs mission earlier that day and returned with a hung Mk 82 bomb, so loading LAU-10/As was seen as a time-saver in order to meet the aeroplane's 1100 hrs launch deadline.

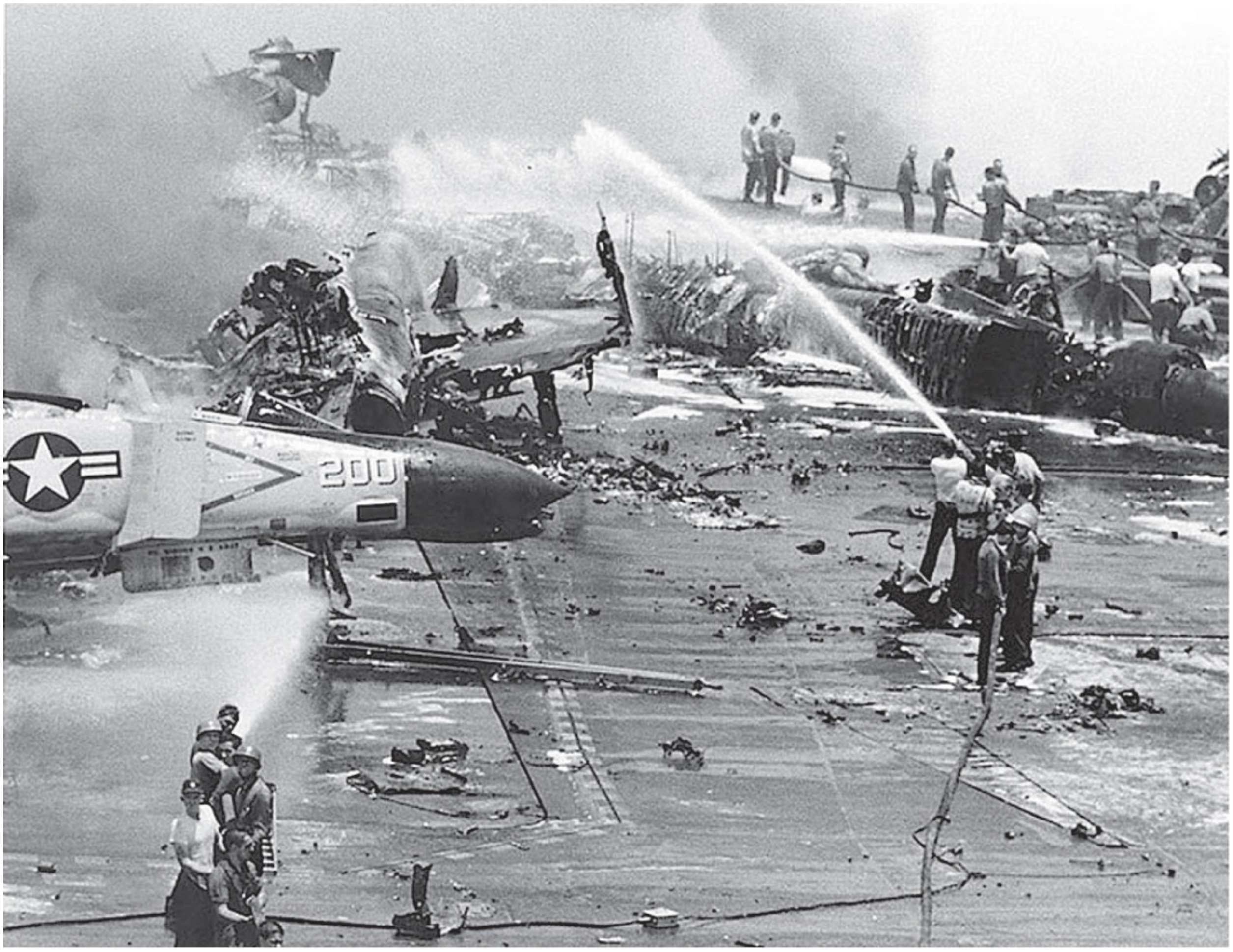


'Red Rippers' F-4B-24-MC BuNo 152307 returns to *Forrestal* with a loaded LAU-10 Zuni pod still on its TER shortly before the catastrophic fire that curtailed the vessel's 1967 cruise. Phantom II missions sometimes included 'Blue Tree' escort for EA-3B 'Queer Whale' ELINT-gathering aircraft, which occasionally elicited a response from the VPAF. On 20 February 1966 a VQ-1 'World Watchers' EA-3B picked up what it took to be the RP-1 Izumrood 1 aiming radar of a MiG-17PF 'Fresco D', running an interception on it over coastal waters. The 'Whale' pilot took evasive action and called in the F-4B escort crew, who initiated an interception of the 'bogie'. Following a typical pattern, the MiG then turned back over the coast near Thanh Hoa and contact was lost (*US Navy*)

Another short cut unofficially employed by *Forrestal*'s deck crew was to attach the 'pigtail' electrical connection between the TER and the rocket launcher receptacle while aircraft were still 'spotted' in their pre-taxi positions on deck. The official instruction was that this last-minute connection should be plugged in 'just before takeoff', which most assumed to imply 'on the catapult' in order to prevent the possibility of inadvertent rocket launching at other aircraft on deck rather than out to sea. The system's other safety back-up was a 'TER pin' that was placed in a receptacle on the rocket-firing intervalometer mechanism, blocking the current from reaching the Zuni and firing it off. TER pins were supposed to remain in place until seconds before launch, but to save further time in the frantic launch schedule of an Alpha package these pins were being removed earlier while the aircraft were still being preflighted. Sadly, deck crewmen were apparently unaware that both these safety measures, each one supervised by different personnel, were being overridden together. They also had little experience of a TER electrical system, which included a switch that was vulnerable to electrical surges.

Lt Cdr James E Bangert, pilot of F-4B BuNo 153061 and squadron safety officer, was unaware of the two conflicting shortcuts, although he had been disquieted to learn that weapons were being armed early to hasten the launch sequences. As he pre-flighted his F-4B a crewman checked all the armament circuits and found no stray voltages, so he plugged in the Zunis' pigtails. Bangert fired up his starboard J79 and signalled to crewmen to disconnect the yellow external power cart used to provide power for the start procedure in the absence of an internal battery. As the F-4B's own electrical systems took over, causing a power surge, there was a tremor beneath the left wing and a single Zuni flashed across the deck and severed an ordnance-man's arm. It then impacted the external fuel tank of an A-4E Skyhawk (Lt Cdr Fred White's AA 405 of VA-46) in the row opposite to the line of F-4Bs. Although it did not explode, the rocket cut into the fuel tank, spraying fuel all over the flightdeck. The A-4E, and those of Lt Cdr John McCain and Lt(jg) David Dollarhide, were instantly engulfed in flames as the fuel was ignited by jet engine exhausts.

There was a possibility that the burgeoning fire could have been contained by *Forrestal*'s vigilant fire crews, but far worse destruction was to follow as two 1000-lb M65 bombs fell from the wing pylons of the A-4Es. The shortage of new, low-drag Mk 83 bombs at the time had forced the ship's commanding officer, Capt John Beling, to accept a delivery of 16 World War 2-vintage M65s from Subic Bay, where they had been subjected to open-air storage in jungle conditions. His initial reaction had been to refuse the bombs, and many of the ship's ordnance men also threatened to boycott the corroded weapons, some of which had been stored since 1953. They were known to be much more heat-sensitive than Mk-series ordnance and susceptible to shock detonation, while their explosive power was actually increased by chemical degeneration during storage.



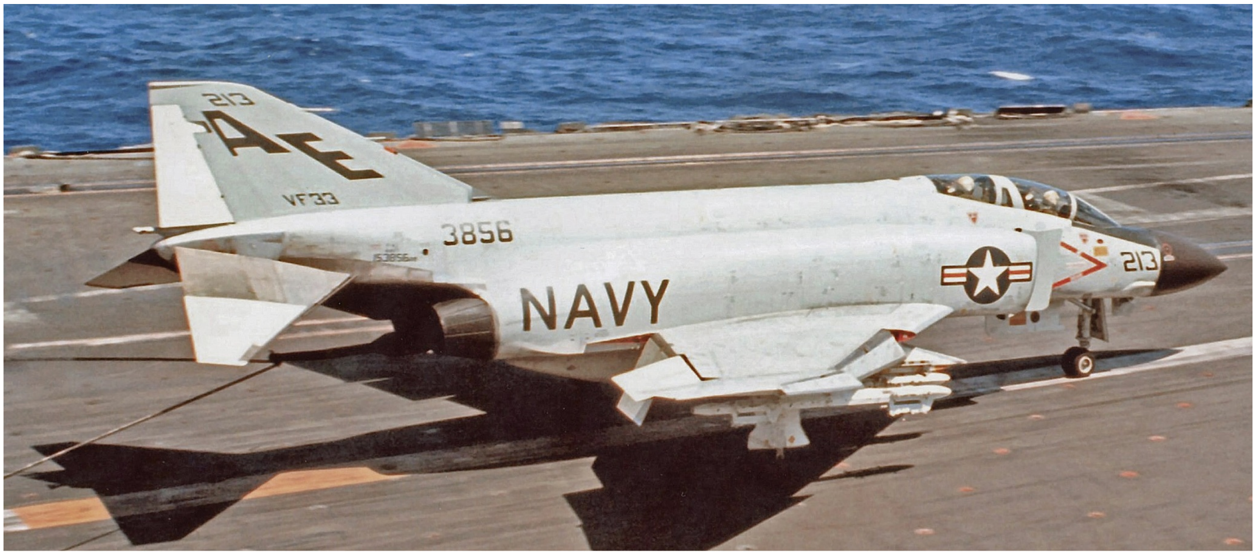
Sailors hose down the smouldering remains of three Phantom IIs on the charred stern of CVA-59 after finally getting the raging fire under control. *Forrestal*'s CVW-1 lost 21 aeroplanes, including seven F-4Bs from VF-11 and VF-74, and a further 34 aircraft sustained serious damage during the hellish conflagration that almost destroyed the ship on 29 July 1967 (*US Navy*)

The suspect bombs were uploaded for the day's strike as early as possible, partly to get them off the ship. When the fire began they started to detonate within 1.5 minutes, rather than allowing a ten-minute window for the firefighters to tackle the blaze as the thicker-skinned Mk 83s would have done. Massive holes were blown through the carrier's flightdeck and blazing fuel cascaded into the lower decks. In all, nine bombs cooked off, and when the fire was eventually defeated after 12 hours 134 men had been killed and many more injured. *Forrestal*'s CVW-1 lost 21 aeroplanes, including seven F-4Bs, and a further 34 aircraft sustained serious damage. CVA-59 returned to the Norfolk Naval Shipyard for an extensive rebuild that cost more then $72m. It was replaced in TF 77 by fellow Atlantic Fleet carrier *America*.

CHAPTER FIVE

REFINING THE BREED

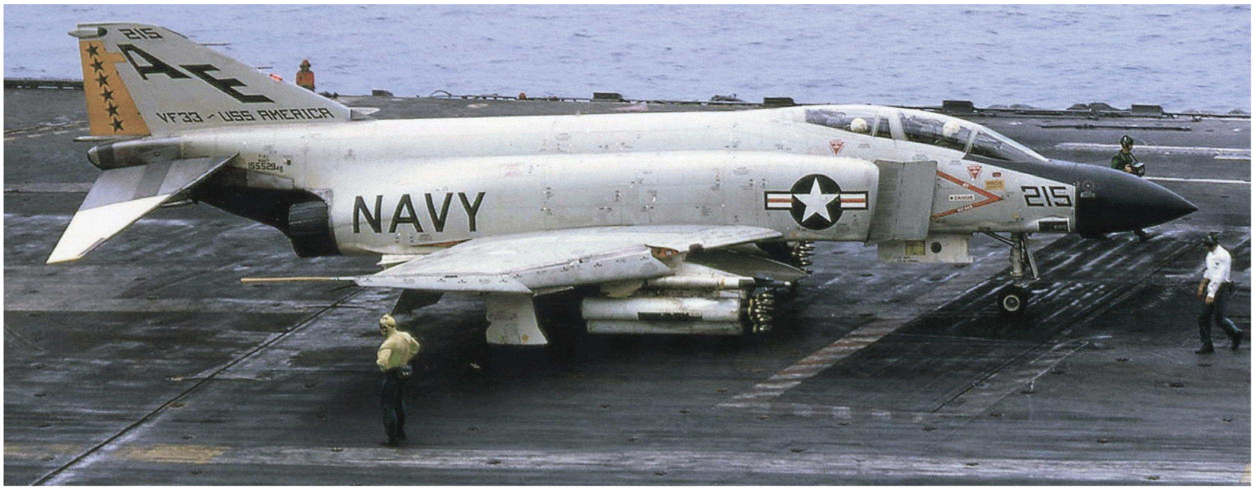
In the F-4B, US Navy pilots received a fighter that had unprecedented thrust, acceleration and weapons capability. It was best at low and medium altitude but, as Capt Fred Staudenmayer observed, 'The supersonic Phantom II manoeuvred poorly at altitude, with not much instantaneous g available. As speed bled off below 300 knots pilots were forced to dive and unload to regain sufficient energy for high-g turns'. MiG killer Lt Cdr Gene Tucker observed that the F-4 'could easily decelerate to a point where it virtually ran out of energy in a tight turning engagement with a proficient MiG pilot'.



VF-33 'Tarsiers' introduced the F-4J to combat in April 1968, and this F-4J-31-MC BuNo 153856, in basic squadron decor, was photographed trapping back onboard CVA-66 with empty MERs and TERs at the completion of a mission. When measured medically, crew stress levels were often found to be higher during a carrier landing than they were during combat. The extra thrust of the F-4J's J79-GE-10 engines was particularly appreciated for ACM. A seventh fuel cell holding 95 gallons was installed in the rear fuselage and the aircraft's increased weight and sink rate necessitated stronger main landing gear with wider tyres, similar to the USAF F-4D's, which reduced wear failure on landing, although they were more prone to aquaplaning on wet runways ashore. There was also a slight deterioration in the aircraft's stall point compared with the F-4B due to the thicker inboard wing section housing the new wheels (*US Navy*)

Whereas the USAF instigated a programme in 1969 to equip its F-4E Phantom IIs with more powerful engines, a nose-mounted gun and (in 1972) leading-edge slats to improve its turning performance, the US Navy initially sought other areas for development, although it eventually equipped its upgraded F-4Ss with similar manoeuvring slats from 1979.

The first major improvements in the naval Phantom II came with the F-4J, first flown in May 1966. As the experience of F-4B squadrons at war became available for study, McDonnell modified the aircraft through the fitment of more powerful J79-GE-10 engines and stabilators with slotted leading edges, the latter increasing control effectiveness on launch and recovery by creating greater rotational forces. The J-model also had significantly better avionics, at the heart of which was the Westinghouse AN/AWG-10 pulse-Doppler fire-control system. This included an AN/APG-59 radar for much-improved target engagement, particularly at low altitudes. The fighter also boasted an AJB-7 bombing system linked to an AN/ASQ-91 weapons release computer for greater accuracy.



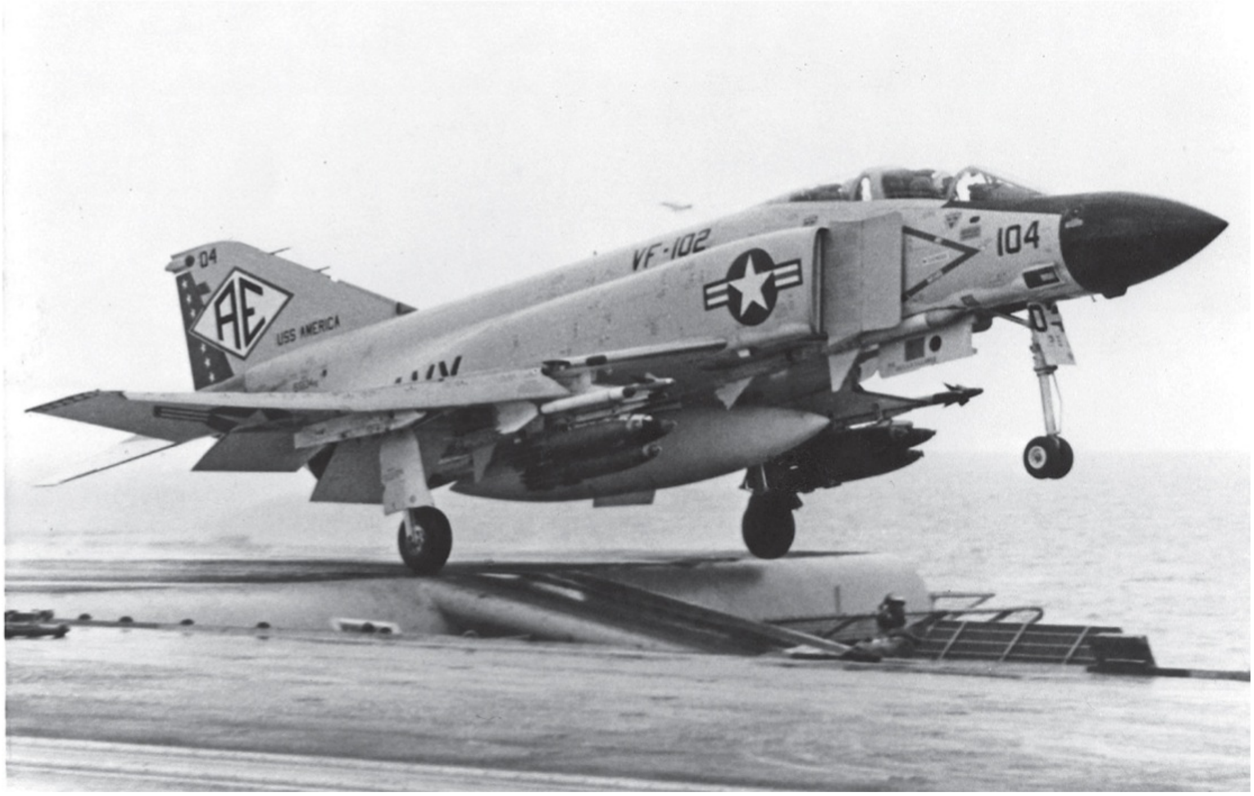
'Rootbeer 215' (F-4J-33-MC BuNo 155529) has acquired the distinctive 'Tarsiers" rudder decor and yellow wing and tail tips, as well as a full load of six Zuni pods and AIM-9D Sidewinders. *America* was the newest carrier to join the conflict, making the first of three deployments in 1968. During VF-33's solitary combat cruise, the unit, under Cdr David Shepherd, experienced four MiG engagements. In three of them early problems with the AWG-10 system lost crews several MiG-kill opportunities, but Lt Roy Cash and Lt(jg) Ed Kain were successful on 10 July, downing a MiG-21 in 'Rootbeer 212'. Eventually upgraded to F-4S specification, BuNo 155529 subsequently served with the Royal Air Force as F-4J(UK) ZE359 and is now on display in the American Air Museum at Duxford (*US Navy*)

AN/AWG-10's search mode calculated the F-4J's closing velocity with the target rather than range from it. The radar could pick up moving targets at up to 120 nautical miles, measuring the speed of the target relative to the F-4. At low altitude it could 'see through' most of the image-degrading returns from the terrain that made conventional pulsed radars unable to find targets in that environment. The AN/AWG-10, first flight-tested in 1964, was capable of excellent target acquisition at the Phantom II's optimum altitudes for air-to-air combat and greatly enhanced the aircraft's chances of a successful missile launch. It offered both Doppler 'look-down' capability against low-flying targets and the search and track facility of a pulse radar. It also had built-in test (BIT) capability to identify faults, although this system was temperamental during the F-4J's first operational deployment onboard *America*. The only downside to the new avionics was that they occupied space in the No 1 fuel cell area behind the cockpits, reducing its capacity to 231 gallons.

The new multi-mode radar, with its own BIT capability, matured into the best system available anywhere at the time, conferring, as RIO Cdr Steve Rudloff observed, 'a major improvement in our ability to track aircraft, especially against low-flying aircraft'. Using the F-4B's AN/APQ-72, 'invariably a MiG would come up from a lower altitude, which meant that you weren't going to pick him up visually until the AWG-10 came along. Of course, MiG-17s and MiG-19s were rather small and difficult to pick up visually'. The radar's ground-mapping mode was also considered very useful.

Training RIOs on the new system required a carefully sequenced programme that prepared them for specific squadrons depending on whether they would be in F-4Bs or F-4Js.

Consistency in checking fire-control equipment aboard ship prior to catapult launch was also lacking, and this caused many 'down' systems in action. The F-4B's systems, with fragile vacuum tube [valve] components, needed a mobile air-conditioning system to be connected to the radar in order to cool it during pre-flight tests. On crowded carrier decks, however, the few air conditioners could not be moved into position fast enough for this. Radars often overheated and failed while aircraft were standing in hot, humid conditions waiting to launch, but their problems were not evident until the aircraft was airborne. Keeping even a proportion of the radars operational was a 'constant battle', as John Nash recalled. 'Some planes just had a lemon for a radar – as much as they worked on it, the radar techs could never maintain the radar in working order'.



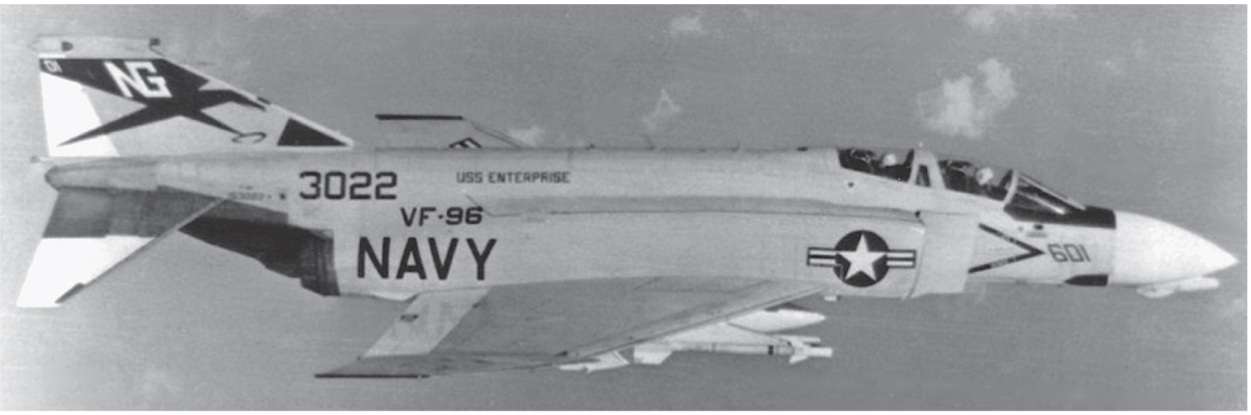
VF-102 'Diamondbacks' F-4J-33-MC BuNo 155534 'Milkvine 104' launches from *America*'s flightdeck in the summer of 1968 armed with Mk 82s, AIM-9Ds and three AIM-7Es. The Sparrow's dense, white smoke trail provided very visible warning to MiG pilots of its approach. Carrier launch weight restrictions often limited AIM-7 carriage to just two missiles, even on TARCAP missions. Shoehorn 4 required only a small AN/ALQ-51/100 fairing under the radome and the previous fin-cap and underside antennas of Shoehorn 3. F-4J-equipped VF-21 and VF-154 joined TF 77 in November 1968 (*via Norman Taylor*)

The F-4J's complex new weapons control system, incorporating around 36,000 electrical parts, took a while to achieve acceptable reliability too. Fred Staudenmayer, serving with VF-33 commanded by Cdr Dave Shepherd in 1968, recalled, 'We got wonderful, reliable new airframes but took on terrific problems with the AWG-10 radar, which posed great challenges until some experience was gained. Some radars would operate for 40 to 50 consecutive flight hours without a hiccup, while others never worked at all'. The integration of solid-state components into the F-4J's AWG-10 gradually alleviated these problems.

The more powerful slotted stabilator, designed in collaboration with Hawker Siddeley in the UK in connection with the Royal Navy's F-4K Phantom II variant and later fitted to many F-4Bs and the F-4E, was combined with a facility to droop the ailerons by 16.5 degrees, reducing landing speed by 12 knots. At the same time the inner leading-edge flaps were locked in the 'up' position, improving airflow over the stabilator. The upgraded 17,900-lb-thrust J79-GE-17 engines with longer tailpipes used an external air start unit, as did the F-4B, rather than the USAF's internal cartridge self-starting system. They also had smoke reduction devices to cut down the F-4's signature smoke trails that had given it the Vietnamese nickname 'fly swatter' (vi ruoi) because of its long 'handle' of smoke. This was particularly visible in Vietnam's humid, hot skies and could only be reduced by using minimum afterburner.

COMBAT DEBUT

In February 1967 VF-41 and VF-84 became the first squadrons to operate and later deploy the F-4J. VF-33 'Tarsiers' and VF-102 'Diamondbacks', assigned to CVW-6, gave the type its combat debut during *America*'s April-December 1968 TF 77 cruise, having received their first examples (lacking AWG-10s) in October 1967. The two squadrons deployed onboard the carrier in January 1968 and them sailed with it to the Atlantic Fleet Weapons Range, where the emphasis was on ground attack techniques with bombs, napalm, rockets and flares. They then made a brief Caribbean cruise, by which time the units had received 13 more recently built F-4Js that were fully equipped with AWG-10 systems and ECM, before departing for Southeast Asia on 10 April via Rio de Janeiro.



Wearing VF-96's new falcon logo, designed in 1968 by Lt(jg) John E Wohlfiel, F-4B-26-MC BuNo 153022 was previously the VF-114 An-2 'Colt' killer for Lt Denny Wisely and Lt(jg) David L Jordan. The revised decor was carried over into the squadron's F-4J era after VF-96 exchanged its Phantom IIs for the battle-worn F-4Bs of VMFA-115 at Chu Lai in July 1968 (from where this aircraft was later lost with VMFA-314 on 11 June 1970) and then moved to the F-4J in September 1968. The first F-4J cruise began badly when a fully loaded VAQ-132 KA-3B tanker exploded on the aft flight deck of *Enterprise* off Oahu, killing ten members of VF-96 and destroying six new F-4Js. The fire that caused the explosion began when an LAU-10/A Zuni pod on a VF-96 aircraft (BuNo 155785) was caught in the hot exhaust of an MD-3A starter unit and cooked off the missiles, causing a major fuel fire (*US Navy*)

Combat operations began on 31 May with a VF-33 air-to-ground mission over North Vietnam led by the CO, Cdr Bill Knutson (in BuNo 155551), who always believed in leading his squadron from the front. 'The normal procedure was to start a new carrier air wing with air-to-ground or other low-risk missions in relatively lightly defended areas to let the crew get their feet wet, before Alpha strikes into the heavily defended areas', Knutson recalled.

On 16 June VF-102's CO, Cdr Walter 'Gene' Wilber, was shot down by a MiG-21 during a CAP near Vinh – his F-4J was the last US Navy aircraft lost to a MiG until April 1972. Vectored onto a group of five MiG-21s, Wilber and his wingman, Lt Emory Brown, had approached them with clearance to fire. They came under intense AAA – probably a flak trap – that the MiGs had drawn them into. Just as they were about to lock onto the VPAF fighters, they received instructions to turn back as they were close to the 19th parallel 'bombing line' that 1968 RoE forbade them to cross.

Usually, the MiGs feinted an attack and then turned back, but on this occasion they kept coming and a warning from the radar controller was received too late. Wilber's aircraft (BuNo 155548 'Milkvine 101') was hit by a missile from behind. Lt Brown had seen two MiG-21s closing on Wilber and sent an urgent warning, but 'Milkvine 101's' radio was being intermittently jammed and the alert went unheeded. Although Brown turned to face the MiGs, they were able to move in behind Wilber and fire an 'Atoll' into the F-4J's tailpipe. Brown (in 'Milkvine 102') then pursued the MiGs, firing two missiles, but he had to turn back at the 19th parallel before observing results. He also had to offer protection to his CO, as Wilber and his RIO, Lt(jg) Bernie Rupinski, ejected. Sadly, only Wilber survived, despite problems with his ejection seat. Cdr F G 'Ted' Fellowes Jr took over the squadron. Brown later learned that his missiles might well have destroyed a MiG, but no details were forthcoming.

Retaliation came on 10 July with the second of two confirmed MiG-21 kills in 1968 after another VPAF attempt at a MiG ambush (using MiG-17s as 'bait') on 22 June. In the latter encounter Lt Gene Tucker of VF-33 lost an almost certain double kill because his AIM-7Es had been uploaded to his F-4J with incorrectly installed firing pins, causing them to fall off the aircraft when launched. Similar problems had occurred previously through failure to renew wafer switches in the firing circuits of other aircraft. Two other F-4Js in Tucker's flight also worked their way into firing positions on the MiGs and launched five more Sparrows, but each one either detonated early or failed to guide correctly. A second 'perfect kill' against MiG-21s on 24 June was frustrated when two AIM-7Es launched by Lt Cdr Ted

Vandewater of VF-96 suddenly broke lock from their targets and homed onto a rocky outcrop instead.

However, the first MiG kill for VF-33 (and the last of *Rolling Thunder*) occurred on 10 July – a better day for US missiles, or at least for the AIM-9. It was also the first MiG kill by an East Coast (Atlantic Fleet) carrier and the first for the F-4J. There would be no more Phantom II aerial combat successes for 18 months. Lt Roy Cash had set a precedent in the F-4 community by being the first RIO to re-train as a pilot. Within a few years the status of RIOs would increase to the point where Fred Staudenmayer, a VF-33 back-seater, became the squadron's commander.

On 10 July 1968, Cash and Lt(jg) Ed Kain were at the controls of 'Rootbeer 212' (BuNo 155553) in a MiGCAP off Vinh with USAF exchange pilot Maj Charlie Wilson and his RIO, Lt(jg) Bill Williams. As Roy 'Outlaw' Cash explained;

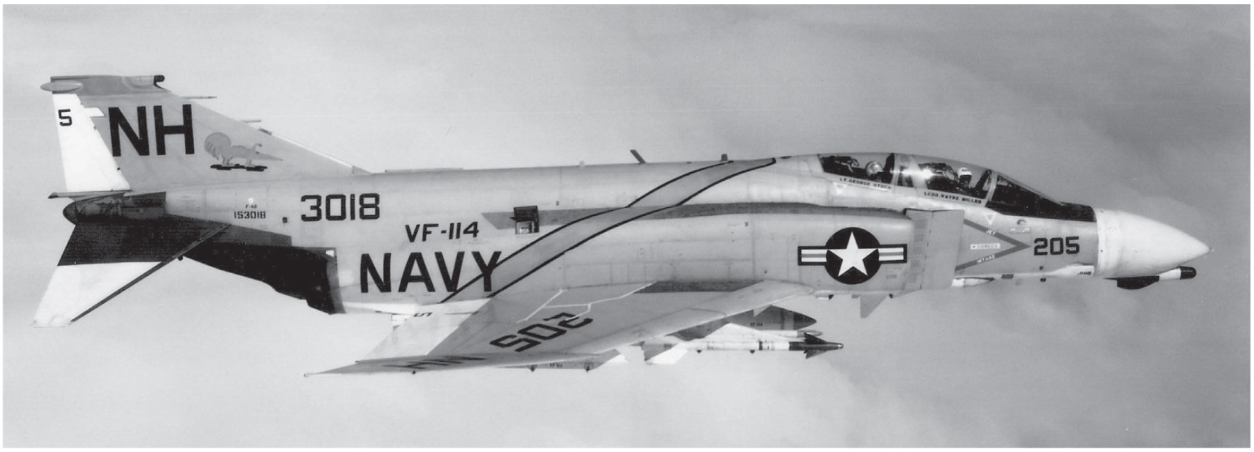
'Charlie and I launched mid-afternoon and we soon determined that his radar was marginal to non-existent, so it was agreed that if we took a vector for bandits I would assume the lead. About one hour into the flight our controller ["Raider" onboard the destroyer USS *Horne* (DLG-30)] called us over "Cipher" frequency to alert us to impending MiG activity. The MiGs' tactics at this point in the war were to dash in over the "no bomb" line, shoot the A-7As [Cash and Wilson were CAPping a US Navy A-7A Corsair II strike near Vinh] and retreat north before fighters could be vectored for them.'

The 'Rootbeer' pair jettisoned their centreline fuel tanks, engaged exhaust smoke reduction and flew at 1500 ft along a ridge of hills until Kain picked up bandits in pulse-Doppler radar mode at a distance of more than 30 miles. He locked the radar on to two MiG-21s at 18 miles as they flew 3500 ft above the F-4Js. With clearance to fire, Cash released two AIM-7Es at five miles' range and they tracked well, but the MiGs were in an orbit, turning across the missiles' trajectory and the Sparrows exploded 100 yards from the target. The MiG pilots, apparently denied their normally comprehensive ground control and warnings because of effective US communications jamming, quickly worked out the direction of the F-4Js' attack and turned towards them, closing to gun range.

'I switched to heat and fired off an AIM-9G Sidewinder', Roy Cash explained, 'but the aspect was more than 90 degrees off at less than 1000 ft so it missed. However, it scared him so badly he continued his descending right break, hit the deck and headed north out of the fight'. The 'Tarsiers' crews were then warned of two more MiG-21s approaching them just as Cash turned in behind the leading MiG of the original pair they had engaged. 'I quickly attained the "six o'clock" at about 1500 yards and fired an AIM-9G. I watched it guide and impact the tail area of the MiG, blowing the empennage completely off'. On return to *America* Cash 'performed the best rendition of a victory roll I could imagine', and he also kept his promise to give up smoking from then on.

VERSATILE 'SPOOKS'

America's fighters, like their predecessors, were tasked with BARCAP, MiGCAP, TARCAP, photo escort, attack and armed reconnaissance during CVA-66's TF 77 combat cruise, with most crews dividing their time roughly equally between air-to-air and air-to-ground sorties. For CAP and escort missions F-4s were armed with two AIM-9D or AIM-9G Sidewinders and three AIM-7E or AIM-7E-2 Sparrows. Six Mk 82 or four Mk 83 bombs were typically added for attack missions, or, occasionally, Zunis and CBUs. Flares were uploaded for virtually all night attack sorties. Often, two F-4Js flew night sorties with an A-6A 'pathfinder' that located targets for the Phantom IIs on its DIANE (Digital Integrated Attack and Navigation Equipment) radar system. Missions were flown with navigation lights switched off, so the risk of collision with other F-4 sections working over the same area meant staggered times-on-target, and pre-briefed targets wherever possible. There was good reason for these precautions. On 15 April 1968 two VF-114 F-4Bs were lost in a mid-air collision during a strike mission, although all four crew were rescued.



Assigned to Lt Cdr Wayne Miller and Lt George Stock, 'Aardvarks' F-4B-26-MC BuNo 153018 has a CAP complement of AIM-7Es and AIM-9Ds, while the open door for the Tracor AN/ALE-29A chaff and flare system suggests that some SAM evasion has been necessary during its March 1968 mission over North Vietnam. On rare occasions the US Navy could fight back with its own SAMs – a MiG-21 was shot down near Vinh on 23 May 1968 by a Talos surface-to-air missile from the cruiser USS *Long Beach* (CGN-9) (*US Navy*)

Attacks were made at altitudes above 3500 ft so to avoid ground fire, keeping VF-102's ground-to-air losses in 1968 to two – one of the jets was downed by a SAM. During their first month of action the 'Diamondbacks' dispensed more than 586,000 lbs of ordnance. Later in the deployment aircraft were launched at their maximum catapult weight of 56,000 lbs, loaded with two AIM-9Gs, two AIM-7Es, four LAU-10 Zuni pods, six Mk 82s and a full centreline fuel tank. Between line periods, VF-102 and VF-33 participated in AIM-7 missile shoots off the Philippines to refine air-to-air tactics and improve missile reliability. Aircraft reliability also improved as the cruise went on, with one VF-102 F-4J ('Milkvine 105') achieving 59 consecutive flights without any maintenance problems.

It had been impossible to incorporate a gun as part of the improvements that led to the F-4J. Although the USAF had put one in its F-4E, centre of gravity problems with the already nose-heavy F-4J when landing back onboard the carrier ruled out a forward-mounted internal weapon. Many debriefs after MiG engagements, dating back to the first on 9 April 1965, included the notion 'If only I'd had a gun' after another missed opportunity at close range. VF-102 did test the Hughes Mk 4 High Performance External Gun pod when the squadron arrived off *Yankee Station* on 24 May 1968, the gun (a revolving cylinder Mk 11 Mod 5 20 mm weapon with 750 rounds and a similar firing rate to the USAF's M61A1 Vulcan) 'proved to be a quite reliable and accurate weapon' according to squadron records.

Although the pod theoretically answered F-4 aircrews' requests, it was not generally adopted for use on carrier-borne Phantom IIs. The US Marine Corps used the Mk 4 gun pod extensively on its F-4s, however, the weapon proving useful for close air support work, despite its tendency to jam after firing a few rounds. On naval F-4s the pod would have taken up the crucial centreline fuel tank pylon, and its accuracy was sometimes affected by the extreme g-forces associated with catapult launching.

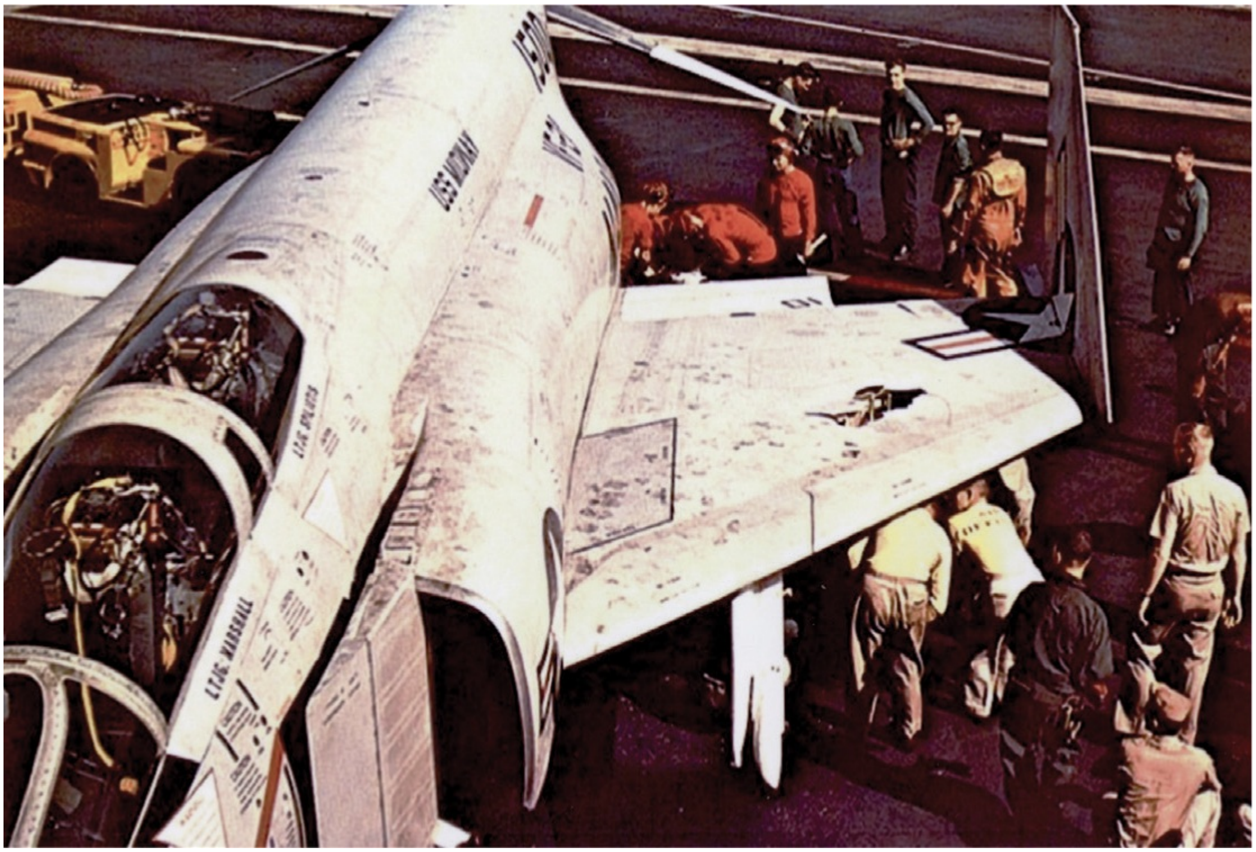
Back at NAS Miramar, via Australia, after its 1968 combat cruise, VF-102's 'Milkvine 112' (BuNo 153886) soaks up the midday sun. Although visibility from the cockpit of a Phantom II was limited, it was superior to the view from a MiG-17 or MiG-21. Forward vision in the latter jets was particularly limited by the MiGs' thick windscreen and a bulky gunsight. Although the MiG-21 could climb almost as well as an F-4 and handle like an F-8 at medium altitudes, its optimum speed at 15,000 ft (where engagements tended to occur) was around 600 knots. Both MiGs had stability and buffeting problems at transonic speeds, and the MiG-17 was hard to control at high speeds and low altitudes. They both had much slower acceleration than the F-4, but the MiGs' small size made them harder to see compared with a smoking F-4 (*Duane Kasulka via Norman Taylor*)

ACHILLES' HEELS

Although the possibility of combat damage was not an important consideration when the F-4's designers conceived the aeroplane for the US Navy's long-range interception mission, the jet proved to be resilient under the unforeseen conditions of Vietnam combat. F-4Bs sometimes returned from missions with most of a stabilator shot off or with large gashes in their structures from AAA or SAM shrapnel damage. Capt Will Haff recalled returning from an RA-5C escort mission during which a round made a substantial hole between the air intake and canopy of his F-4B. 'I guess it was a non-VT [variable time] fused round or a plain steel projectile, as it just passed through the aircraft. The F-4 could take a good shot and still make it home'.

However, the aeroplane's three hydraulic systems were extremely susceptible to even minor small-arms damage, causing rapid loss of control as the hydraulic pressure drained away. Hydraulic damage was the most common factor in wartime F-4 losses. As the two main systems (PC-1 and PC-2) lost pressure the horizontal stabilator moved to the maximum 'climb' position, causing the Phantom II to make a high-g loop and then stall out of control. Placing the control column in the neutral position to lock the stabilator could reduce this behaviour. The density of the F-4's internal structure made it virtually impossible to provide protection for the hydraulic lines, or install a further back-up system as was done with the equally vulnerable F-105 Thunderchief. Several pilots succeeded in guiding their aircraft to a safe bail-out point by using only the rudder and throttles when the other controls were damaged.

VF-21's Lt Cdr Duke Hernandez and Lt(jg) S L Vanhorn were able to do this in F-4B BuNo 151492 after sustaining hydraulic damage during their 16 December 1967 flak suppression sortie in support of an attack on a road ferry at Kien An. Both men successfully ejected over the sea and were rescued by a US Navy SAR helicopter. Hernandez was forced to take to his parachute once again on 28 April 1968 after his F-4B (BuNo 153014) suffered an engine fire following AAA damage during an attack on NVA storage caves at Ben Thuy. He and his RIO, Lt(jg) David Lortscher, were plucked from the sea by a US Navy SAR helicopter. This was the first of four Phantom II ejections endured by Lortscher, although this particular event was the only one caused by enemy action.



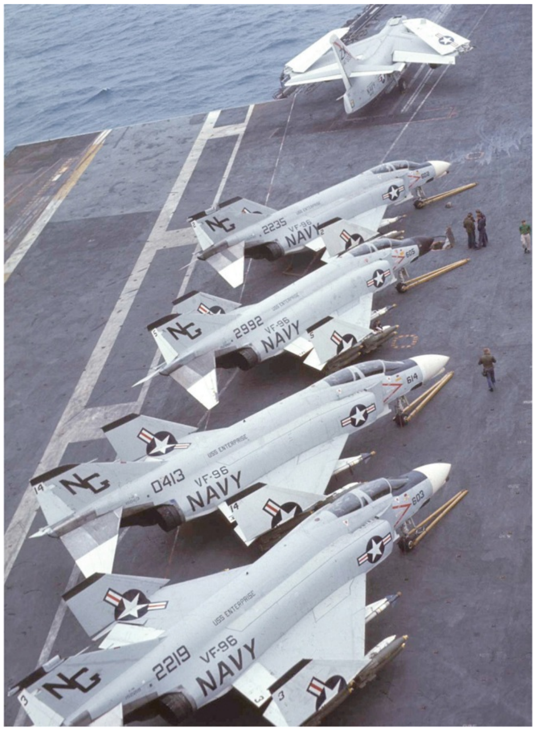
Despite their dense, complex structure, F-4s could stand having chunks knocked out of them by enemy action.

Here, deck crew inspect flak damage to the left wing of VF-21 F-4B-20-MC BuNo 151500 assigned to Lt(jg) Jerry T Marshall and Lt Harry C Spiliotis in 1965. The following year, on 13 July, as 'Rock River 216' with VF-161 'Chargers', it scored a MiG-17 kill with Lts Bill McGuigan and Bob Fowler at the controls. BuNo 151500 was finally shot down by AAA during a US Marine Corps night TPQ-10 radar-bombing mission by VMFA-115 over Laos on 23 May 1968 (*US Navy via C Moggeridge*)

The lack of a second two-way radio was another handicap in combat, as strike, control and escort elements often operated on different frequencies and vital information could be missed by monitoring only one channel. SAM and MiG warnings were sometimes obliterated by excessive transmissions from support aircraft and F-4s were lost as a result. Changing frequencies was necessary to try and catch relevant transmissions or to switch from a wavelength that was jammed with excessive traffic. An emergency Guard frequency was an alternative for SAR use, although this was often blocked by the penetrating squeal of emergency beepers activated by aircrew who had ejected from their aircraft. The post-combat report following a MiG kill by Lts Bill McGuigan and Bob Fowler described a common experience, which was by no means confined to F-4 squadrons. 'The radios were cluttered with messages during the entire flight, making flight coordination extremely difficult'.

Another unforeseen problem occurred early in the F-4J's service life with VF-33 on 4 June 1968. Lt Eric Brice and Lt(jg) Bill Simmons took a 37 mm hit in BuNo 155554 while dropping Mk 82 bombs on a road intersection near Vinh. Hydraulic failure was soon followed by a fire, and Eric Brice ordered his RIO to eject – which he did. However, despite strenuous efforts he was unable to jettison his own canopy and escape before the Phantom II hit the sea. The squadron's executive officer, Cdr Orville Elliott, had a similar experience on 24 July. Blasted by an AAA site that he was bombing in the Vinh area, he used the rudder to persuade his F-4J (BuNo 155551) out past the coast, at which point he ordered his RIO, Lt(jg) Andris Dambekaln, to eject when fire warning lights started to glow. Like Brice, Elliott was unable to release his canopy once the back-seater had ejected;

'I knew that once I rotated the black canopy lock handle aft, the canopy was unlocked and just sitting there, but I couldn't do anything about it. I turned the engine masters off and figured I had better tell someone why I didn't get out. I keyed the mike and said "I can't get out", but then the generators went off line and I lost the radio. So I went back to pushing the canopy and pretty soon had it off. Everything after that was normal. I was picked up by a helo and was back in combat two or three days later.'



VF-96 was allocated 6xx-series Modex side-numbers for its *Enterprise* cruises between 1965 and 1968, while sister-squadron VF-92 used the 200-series. Snakeye-armed 'Showtime 603' (formerly the VF-21 MiG-killer for Batson and Doremus) apparently flew into the sea during ACM practice against the squadron CO, Cdr 'Lefty' Schwarz, over the Gulf of Tonkin on 12 February 1967, killing Lt Cdr Marty Sullivan and Lt(jg) Paul V Carlson. Here it has the Melpar AN/APR-24 ECM fit, as does 'Showtime 602'. BuNo 150413 was hit by AAA in an attack near Thanh Hoa on 20 February 1967 and RIO Ens Gary Thornton ejected at 250 ft, surviving six years in prison. His pilot, USAF exchange officer Maj Russell Goodman, is believed to have been killed in the crash (*US Navy*)

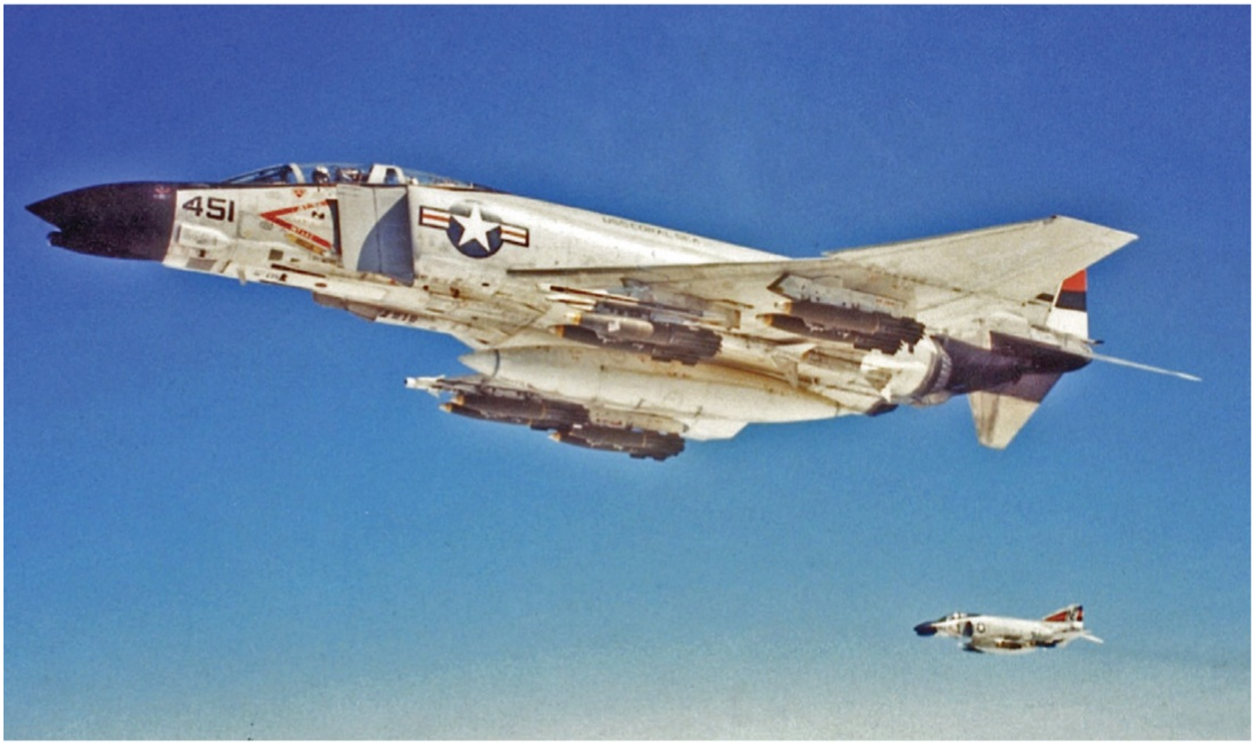
This problem was not confined to the F-4J. The previous day Maj Gen Robert Worley, vice-commander of the Seventh Air Force, was trapped in a burning RF-4C when he elected to fly a reconnaissance mission near Hue. The Phantom II took ground fire and back-seater Maj Robert Brodman ejected, but Maj Gen Worley was unable to escape from the blazing aircraft. An investigation revealed that a venturi effect occurred in the F-4's front cockpit after the rear canopy had gone, the 400-knot airflow forcibly keeping the front canopy in place. The solution was to install two small pistons under the front end of the pilot's canopy to push it open when the ejection seat handle was pulled.

There were some circumstances in which no amount of technological innovation could save the day, with foul weather being one persistent enemy throughout many missions. On *Enterprise*'s very first day in combat – 2 December 1965 – Lt(jg)s Robert Miller and G F Martin of VF-96 found that the gigantic carrier's flightdeck was pitching so violently in a storm that they could not land (in F-4B BuNo 149468) despite several attempts and subsequent ‘bolters’. They then had problems topping up their fuel from an A-4 tanker and eventually had to eject near CVAN-65 when their fuel state fell below 300 lbs. Squadronmates Lt Dean Forsgren and Lt(jg) Robert Jewell had a similar experience on 28 December after an armed reconnaissance mission when their F-4B (BuNo 151438) ran out of fuel while trying to ‘trap’ in appalling weather, and they too were recovered by a Seasprite helicopter while their Phantom II sank into the Gulf of Tonkin.

Combat operations performed by F-4J units closely resembled those flown by squadrons equipped with F-4Bs earlier in the war. They were subjected to the same range of ground defences, except that the SAM and AAA threat had increased and spread into Laos and beyond the Hanoi/Haiphong areas of North Vietnam during President Johnson’s bombing pause. Lt Cdrs John Holtzclaw and John Burns of VF-33 were faced with an unexpected SAM site when they were escorting an A-6C Intruder equipped with a belly-mounted TRIM (Trails/Roads Interdiction Multi-sensor) electro-optical night vision pod on a truck-hunting reconnaissance north of Vinh on 18 June 1968. Three SA-2s were fired at their F-4J (BuNo 155546) with minimal warning.

Like many previous pilots, Holtzclaw was able to out-manoeuvre two SAMs, but his aircraft had lost too much energy to evade the third, which blew a wing off the Phantom II. The crew ejected, landing 150 ft apart. They duly became the focus of an incredible rescue by Lt Clyde Lassen and his UH-2 Seasprite crew from HC-7, embarked in the destroyer USS *Preble* (DLG-15). Lassen returned repeatedly to the downed airmen despite heavy enemy fire, including a SAM that was aimed at the helicopter. They landed three times, mostly in total darkness, to try and reach Holtclaw and Burns as they ran from enemy troops to seek a pick-up area. Lassen finally settled his Seasprite in a rice field, taking heavy fire from three sides as his door-gunners fought back with machine gun fire. The downed Naval Aviators fought their way through dense undergrowth and rice paddy fields to climb aboard.

After almost an hour in hostile territory, including 45 minutes under enemy fire, Lassen was able to take off, evade more AAA as he crossed the coast and land on the radar picket destroyer USS *Jouett* (DLG-29) with only five minutes’ fuel remaining in his badly damaged helicopter. Lassen received the Medal of Honor for his extraordinary achievement, thus becoming the first Naval Aviator to receive America’s highest military decoration during the Vietnam conflict.



A section of VF-154 Phantom IIs (with F-4B-25-MC BuNo 152974 in the foreground), both of which are armed with four TERs of Mk 82 SE bombs, head for North Vietnam in late 1966. Radio problems between a pair of aircraft such as these could be exacerbated when turning hard, causing the UHF antenna to be blanked off by the F-4's wing. Despite frequent requests from aircrew, a second UHF radio was not installed until many F-4Js were re-built in the F-4S programme – upgraded jets boasted two AN/ARC-159 radios. Still with the 'Black Knights', BuNo 152974 was hit by small-arms fire while dropping Mk 82 bombs on the Thu Diem bridge on 4 January 1967. Both crewmen ejected and were rescued (*Terry Edwards*)

'BEACON' BOMBING

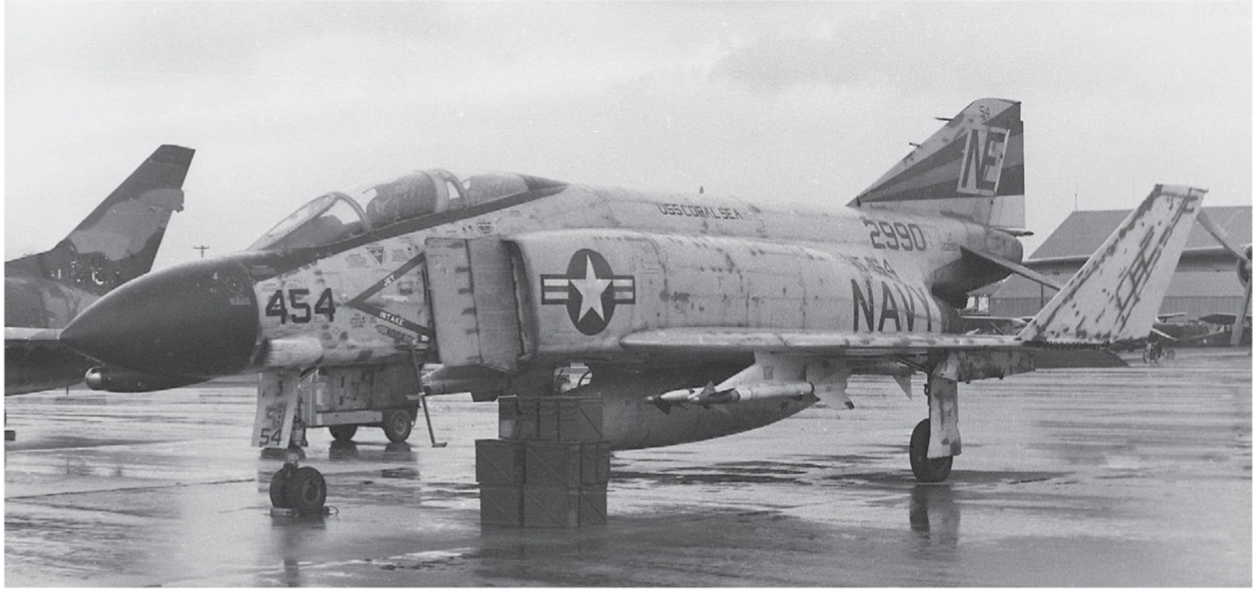
Southeast Asia's notorious climate, particularly during the monsoon season, often grounded all US strike aircraft apart from the A-6A and F-111A, giving the enemy time to repair damage and re-locate his defence assets. The only alternative to suspending bombing by other types was the radar-controlled blind bombing facility provided by ground-based US Marine Corps TPQ-10 or USAF MSQ-77 Combat Skyspot or TSQ-81 units. Formations of aircraft, sometimes of several different types and units, could drop their ordnance from straight and level flight on a given signal from the ground station, using the aircraft's TACAN to plot position.

Flying above a dense cloud base allowed little warning of SAMs or heavy AAA, so radar bombing was usually restricted to the Route Packs with fewer defences. It was also the only way for many USAF strikes to hit the Hanoi-Haiphong area during the unusually poor weather that blighted North Vietnam from November 1967 to

March 1968. Accuracy generally was compromised by the lack of detailed target maps and the difficulty in assessing bombing results.

'Beacon' missions were seen as useful harassment exercises, particularly at night, and losses were generally low. VF-154, flying from *Ranger* during its 1967-68 cruise, came through without any combat losses, but a navigation problem on 10 January 1968 cost the unit two F-4Bs. Its CO, Cdr (later Capt) Will Haff, recalled;

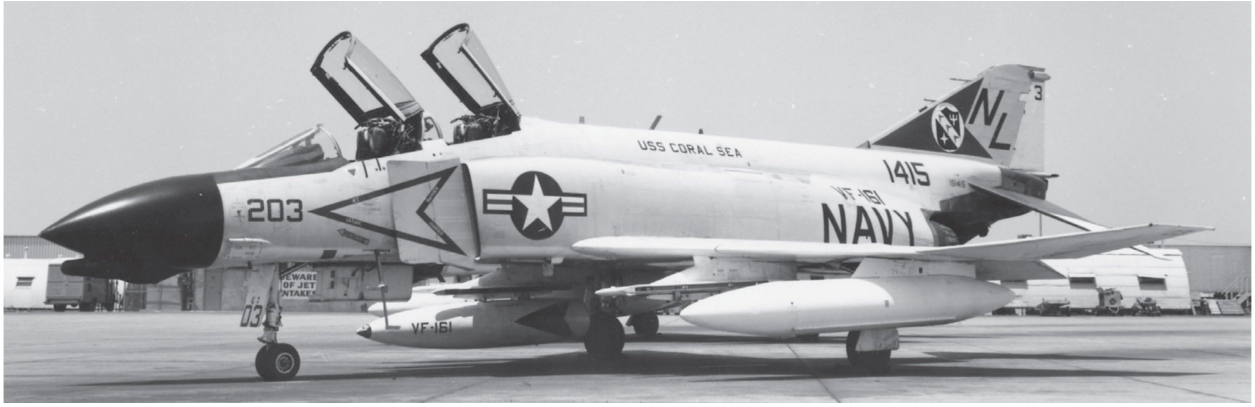
'Lt Cdr Lew Mitchell led a flight of two F-4Bs into Laos for a radar-controlled bomb release above overcast. Returning to *Ranger*, they apparently homed in on the northern SAR destroyer's TACAN for the let-down through the overcast. When they broke out underneath the "clag" there was no carrier, only a destroyer and some shoreline, and they were a hundred miles north of *Ranger* with minimum fuel. The KA-3B tanker was far away over *Ranger*, where the recovery of a strike force was underway. A fiasco followed – both crews ejected and the two F-4Bs [BuNos 151499 and 151506] were lost from fuel exhaustion due to crew error and poor radar control from the destroyer and from *Ranger*.'



Long Westpac deployments took their toll on airframes that were constantly subjected to the sea and weather. Cdr Ken Wallace's maintainers have obviously done their best to patch up the paintwork of VF-154 F-4B-25-MC BuNo 152990, ashore from *Coral Sea* at Da Nang in 1967. The jet survived the war and was converted into an F-4N, continuing in service until November 1983 (*US Navy*)

By the end of 1968 the F-4 had become the most important multi-role type available to the US Navy during the war. Its success in all three services led to additional export orders, and total production figures for all users placed it close to the 5400 copies of the most-produced post-war US fighter, the F-86 Sabre. The majority of the naval examples were F-4Bs (649 manufactured by mid-1966), followed by 522 F-4Js. Many of these also spent time in US Marine Corps units, where their roles were predominantly ground attack. Despite some misgivings about its all-missile armament and manoeuvrability in aerial scraps, the Phantom II steadily replaced the gun-and-missile-armed F-8 Crusader, the last single-seat air superiority naval fighter. The F-4 was heavier and had a higher wing loading than its predecessor, but its excess power and great stability won over many former single-seat pilots. When it first entered service it was thought to be too bulky and unmanoeuvrable to be anything other than an interceptor. In Vietnam it was proven to be a fighter as well.

After F-8 units VF-51 and VF-111 made the Crusader's final two MiG kills in January 1968, a number of pilots from these units converted, somewhat reluctantly in some cases, to the F-4, and they would employ it to even greater success in the next phase of the air war, Operation *Linebacker*. Unlike *Rolling Thunder*, which, even in the judgement of the White House did not significantly reduce North Vietnam's military capability, *Linebacker* allowed the 'gloves off' assault that US Navy pilots had advocated since 1964.



VF-161's decor added an arrowhead intake warning band after the 1968-69 cruise onboard *Coral Sea*. F-4B-16-MC BuNo 151415 also has the AN/APR-25 and AN/ALQ-51 Shoehorn antenna modifications under the radome (in an F-4D-style fairing) and in the single fin-top housing. Jets from VF-151 and VF-161 were the first to receive these fairings, fitted during 1967-68. Small AN/APR-25 aft hemisphere disc antennas also appeared on a revised drag 'chute housing. The last F3H Demon squadron to convert to the F-4B, VF-161 had scored six MiG kills by 1973, including the last of the Vietnam War (*US Navy*)

APPENDICES

US Navy F-4 Phantom II Unit Deployments to TF 77 1964-69

Unit	Code/Modex	Carrier Air Wing	Carrier	Deployment Dates
VF-11	AA 1--	CVW-17	USS *Forrestal* (CVA-59)	6/6/67 to 14/9/67

Notes – Converted from F-8E Crusader to F-4B in 1966. One combat cruise from Sixth Fleet, terminated by fire onboard CVA-59. Converted to F-4J 9/72

VF-14	AB 1--	CVW-1	USS *Franklin D Roosevelt* (CVA-42)	21/6/66 to 21/2/67

Notes – Converted from F3H-2N Demon to F-4B in May 1963. Deployed onboard CVA-42 until 1967, then USS *John F Kennedy* (CV-67) 1969-73. One combat cruise from Sixth Fleet

VF-21	NE 1--	CVW-2	USS *Midway* (CVA-41)	6/3/65 to 23/11/65
	NE 1--	CVW-2	USS *Coral Sea* (CVA-43)	29/7/66 to 23/2/67
	NE 1--	CVW-2	USS *Ranger* (CVA-61)	4/11/67 to 25/5/68
	NE 1--	CVW-2	USS *Ranger* (CVA-61)	26/10/68 to 17/5/69

Notes – Converted from F3H Demon to F-4B in late 1962. Converted to F-4J in July 1968

VF-32	AB 2--	CVW-1	USS *Franklin D Roosevelt* (CVA-42)	21/6/66 to 21/2/67

Notes – Converted from F-8D Crusader to F-4B in late 1965. One combat cruise from Sixth Fleet, remained with CVA-42 until 1968, then to CV-67 (1968-73)

VF-33	AE 2--	CVW-6	USS *America* (CVA-66)	10/4/68 to 16/12/68

Notes – Converted from F-8E Crusader to F-4B in 1964. One combat cruise from Sixth Fleet after conversion to F-4J in October 1967. Flew F-4J until 1981, longer than any other squadron

VF-41	AG 1--	CVW-7	USS *Independence* (CVA-62)	10/5/65 to 13/12/65

Notes – Converted from F3H Demon to F-4B in 1962. One combat cruise from Sixth Fleet. Converted to F-4J in February 1967

VF-74	AA 2--	CVW-17	USS *Forrestal* (CVA-59)	6/6/67 to 14/9/67

Notes – Combat cruise from Sixth Fleet ended by CVA-59 fire. VF-74 made a second combat cruise, onboard *America,* in 1972-73 after conversion to F-4J in 1972

VF-84	AG 2--	CVW-7	USS *Independence* (CVA-62)	10/5/65 to 13/12/65

Notes – Converted from F-8C Crusader to F-4B in July 1964. One combat cruise from Sixth Fleet. Converted to F-4J in 1967

VF-92	NG 2--	CVW-9	USS *Ranger* (CVA-61)	5/8/64 to 6/5/65
	NG 2--	CVW-9	USS *Enterprise* (CVAN-65)	26/10/65 to 21/6/66
	NG 2--	CVW-9	USS *Enterprise* (CVAN-65)	19/11/66 to 6/7/67
	NG 2--	CVW-9	USS *Enterprise* (CVAN-65)	3/1/68 to 18/7/68

Notes – Converted from F3H Demon to F-4B November in 1963 and then to F-4J in 1968. Eight combat cruises in all from 1964 to 1973

VF-96	NG 6--	CVW-9	USS *Ranger* (CVA-61)	5/8/64 to 6/6/65
	NG 6--	CVW-9	USS *Enterprise* (CVAN-65)	26/10/65 to 21/6/66
	NG 6--	CVW-9	USS *Enterprise* (CVAN-65)	19/11/66 to 6/7/67
	NG 6--	CVW-9	USS *Enterprise* (CVAN-65)	3/1/68 to 18/7/68

Notes – Formerly VF-142, the re-designated squadron took over VF-142's F-4Bs on 1/6/62. Eight combat cruises in all from 1964 to 1973. Converted to F-4J in 1968

VF-102	AE 1--	CVW-6	USS *America* (CVA-66)	10/4/68 to 16/12/68

Notes – Converted from F4D-1 Skyray to F-4B in September 1961 as second East Coast F-4 squadron. Converted to F-4J in early 1968. One combat cruise from Sixth Fleet

VF-114	NH 4--	CVW-11	USS *Kitty Hawk* (CVA-63)	19/10/65 to 13/6/66
	NH 2--	CVW-11	USS *Kitty Hawk* (CVA-63)	5/11/66 to 20/6/67
	NH 2--	CVW-11	USS *Kitty Hawk* (CVA-63)	18/11/67 to 28/6/68
	NH 2--	CVW-11	USS *Kitty Hawk* (CVA-63)	30/12/68 to 4/9/69

Notes – Converted from F3H Demon to F-4B in late 1961. First deployed West Coast F-4 unit. Converted to F-4J in October 1969. Seven combat cruises in all from 1964 to 1973

VF-142	NK 2--	CVW-14	USS *Constellation* (CVA-64)	5/5/64 to 1/2/65
	NK 2--	CVW-14	USS *Ranger* (CVA-61)	10/12/65 to 25/8/66
	NK 2--	CVW-14	USS *Constellation* (CVA-64)	29/4/67 to 4/12/67
	NK 2--	CVW-14	USS *Constellation* (CVA-64)	29/5/68 to 31/1/69

Notes – Converted from F3H Demon to F-4A in January 1962, then to F-4B in late 1963. Re-established in October 1963 after the original unit was re-designated VF-96. Converted to F-4J in 1969. Seven combat cruises in all from 1964 to 1973

VF-143	NK 3--	CVW-14	USS *Constellation* (CVA-64)	5/5/64 to 1/2/65
	NK 3--	CVW-14	USS *Ranger* (CVA-61)	10/12/65 to 25/8/66
	NK 3--	CVW-14	USS *Constellation* (CVA-64)	29/4/67 to 4/12/67
	NK 3--	CVW-14	USS *Constellation* (CVA-64)	29/5/68 to 31/1/69

Notes – Converted from F3H Demon (as VF-53) to F-4B in 1962. Converted to F-4J in 1969. Seven combat cruises in all from 1964 to 1973

VF-151	NL 1--	CVW-15	USS *Coral Sea* (CVA-43)	7/12/64 to 1/11/65
	NL 1--	CVW-15	USS *Constellation* (CVA-64)	12/5/66 to 3/12/66
	NL 1--	CVW-15	USS *Coral Sea* (CVA-43)	26/7/67 to 6/4/68
	NL 1--	CVW-15	USS *Coral Sea* (CVA-43)	7/9/68 to 18/4/69

Notes – Converted from F3H Demon to F-4B in early 1964 and to F-4N in March 1973. Seven combat cruises in all from 1964 to 1973

VF-154	NE 4--	CVW-2	USS *Coral Sea* (CVA-43)	29/7/66 to 23/2/67
	NE 4--	CVW-2	USS *Ranger* (CVA-61)	4/11/67 to 25/5/68
	NE 2--	CVW-2	USS *Ranger* (CVA-61)	26/10/68 to 17/5/69

Notes – Converted from F-8D Crusader to F-4B in November 1965 and to F-4J in August 1968. Six combat cruises in all from 1965 to 1972

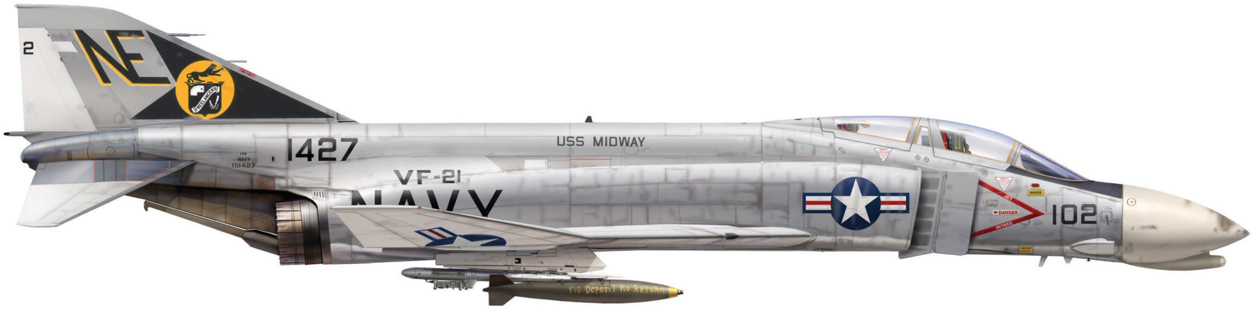
VF-161	NL 2--	CVW-15	USS *Constellation* (CVA-64)	12/5/66 to 3/12/66
	NL 2--	CVW-15	USS *Coral Sea* (CVA-43)	26/7/67 to 6/4/68
	NL 2--	CVW-15	USS *Coral Sea* (CVA-43)	7/9/68 to 18/4/69

Notes – Converted from F3H Demon (the last F-4 unit to do so) to F-4B in November 1964 and to F-4N in March 1973. Seven combat cruises from 1964 to 1973

VF-213	NH 1--	CVW-11	USS *Kitty Hawk* (CVA-63)	19/10/65 to 136/66
	NH 1--	CVW-11	USS *Kitty Hawk* (CVA-63)	5/11/66 to 20/6/67
	NH 1--	CVW-11	USS *Kitty Hawk* (CVA-63)	18/11/67 to 28/6/68
	NH 1--	CVW-11	USS *Kitty Hawk* (CVA-63)	30/12/68 to 4/9/69

Notes – Converted from F3H Demon to F-4B/G in July 1964 and to F-4J in August 1969. Six combat cruises in all from 1965 to 1972

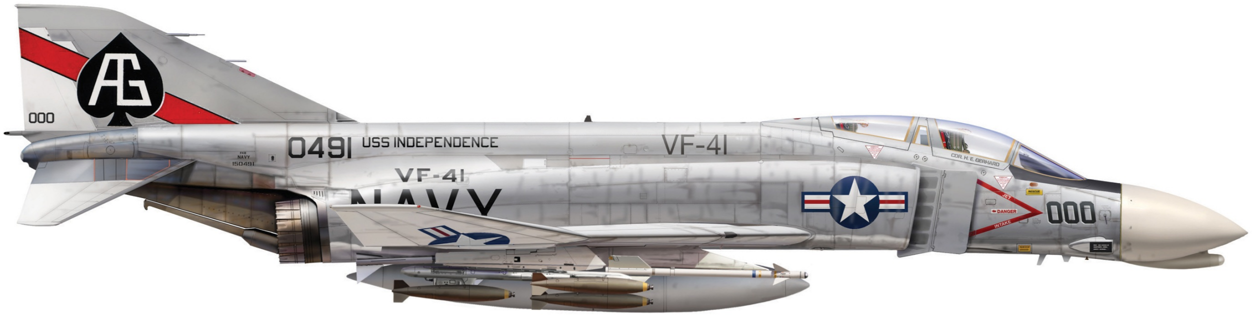
COLOUR PLATES



1

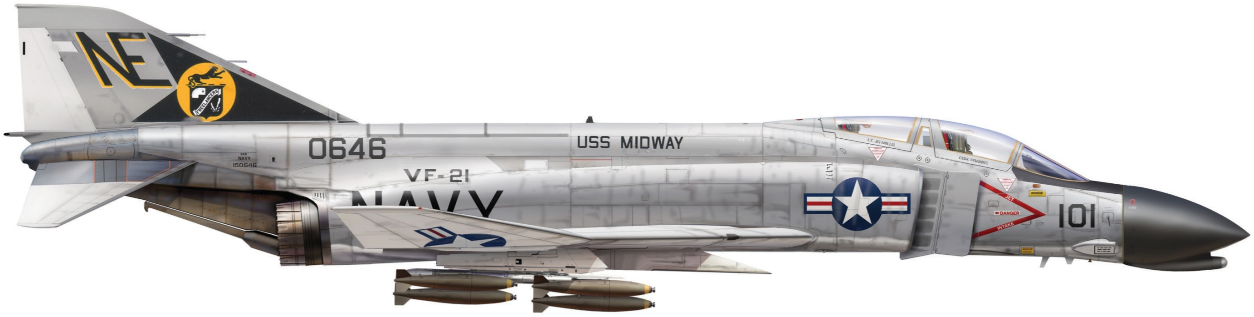
F-4B-17-MC BuNo 151427/NE 102 of VF-21, USS *Midway* (CVA-41), June 1965

VF-21 was among the earliest units to transition to the F-4B, making its first deployment onboard CVA-41 in November 1963. During its second *Midway* cruise from March to October 1965 it completed five line periods of combat totalling 144 days with TF 77. This F-4B, later transferred to US Marine Corps unit VMFA-323, has graffiti-inscribed 1000-lb Mk 82 low-drag bombs uploaded rather than air-to-air missiles. On 2 May 1973, whilst still serving with VMFA-323, this aircraft suffered an in-flight fire during a training mission and crashed.



2

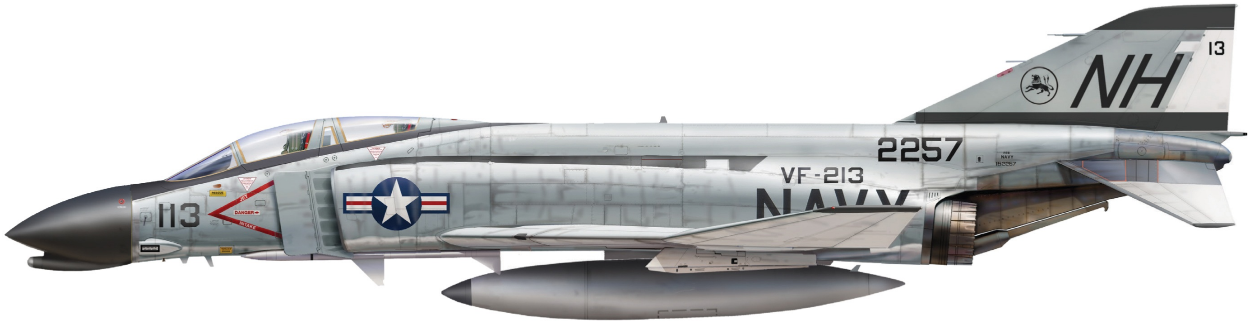
F-4B-14-MC BuNo 150491/AG 000 of VF-41, USS *Independence* **(CVA-62), August 1965**
As one of the first Atlantic Coast F-4B units, VF-41 flew air defence sorties during the Cuban Missile Crisis and pioneered ground attack tactics with a wide range of weapons including the ubiquitous Mk 82 bombs seen here. The squadron made one Vietnam War deployment with CVW-7 onboard *Independence* from June to November 1965. AG 000 was the CVW-7 'CAG' aircraft, and it later served in a similar role for CVW-5 with VF-161 as NF 100 after conversion to F-4N configuration. Withdrawn from service in 1977, the veteran jet became a range target at Indian Springs, in Nevada, in 1983.



3

F-4B-14-MC BuNo 150646/NE 101 of VF-21, USS *Midway* (CVA-41), June 1965

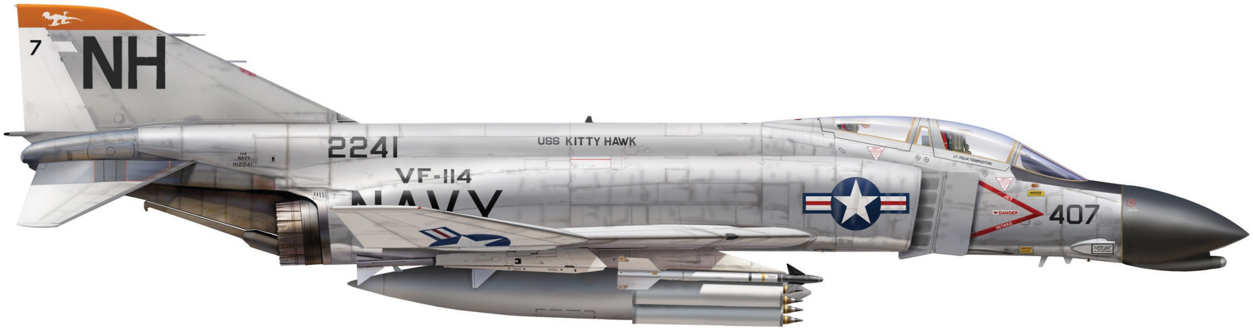
VF-21 claimed two of the first three MiG kills credited to US Navy F-4s, one of them being downed by Cdr Lou Page and Lt J C Smith in this F-4B (assigned to the squadron CO Cdr Bill Franke) – the victory was later marked up on their own assigned aircraft, NE 102. BuNo 150646 was the first official F-4 MiG killer, but it was also VF-21's first loss the following month when its electrical systems failed during a CAP mission on 28 July 1965.



4

F-4B-20-MC BuNo 152257/NH 113 of VF-213, USS *Kitty Hawk* (CVA-63), December 1965

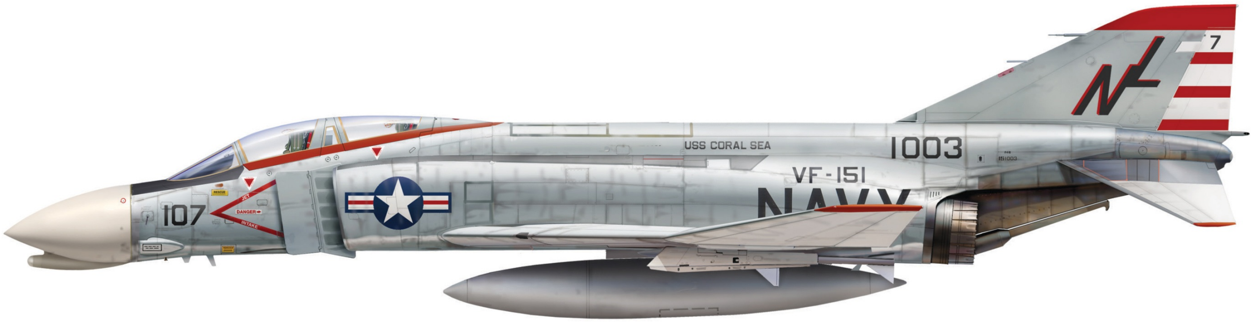
Although VF-213 deployed in October 1965 as a 'data-link' F-4G unit, two F-4Bs (including this jet) were also used. NH 113 carries the centreline 600-gallon fuel tank that was standard for most US Navy missions. BuNo 152257 was lost on 18 May 1966, near the end of the combat cruise, when it was hit while flying at 500 ft whilst its crew tried to identify the wreckage of a downed USAF O-1F Bird Dog FAC aircraft near Ban Karai, in Laos. Lt Cdrs C N Sommers and W K Sullivan were rescued by a USAF HH-3E helicopter.



5

F-4B-21-MC BuNo 152241/NH 407 of VF-114, USS *Kitty Hawk* (CVA-63), December 1965

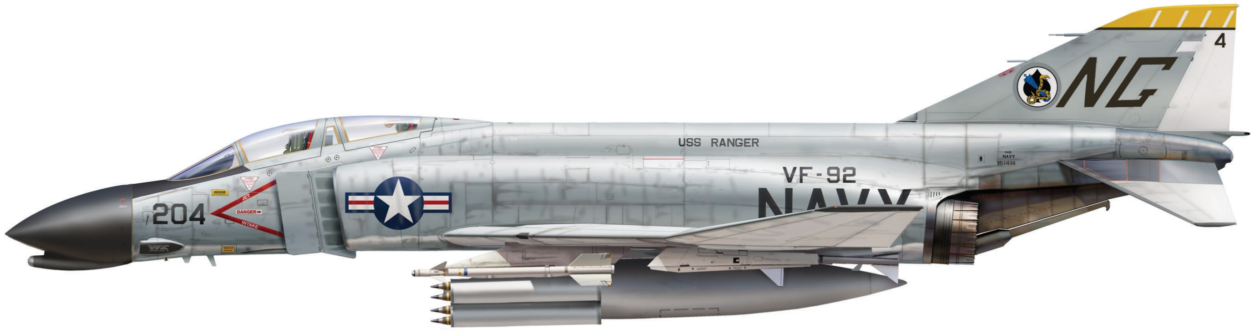
VF-114, the first deployable Pacific Fleet F-4 unit, joined VF-213 for six combat cruises aboard *Kitty Hawk*, beginning in October 1965. This aircraft carried the name of Lt Felix E Templeton on its canopy rail. As VF-114's first 'triple centurion', Templeton made his 300th arrested landing on 3 April 1966. Previously, he had performed the ship's 16,000th trap on 17 August 1963 in F-4B 'Linfield 401'. Following three years of combat flying with TF 77, that figure had increased to 50,000 landings. The Zuni 5-in rocket pods carried here by NH 407 were found to be particularly effective against ground targets, including AAA sites. BuNo 152241 was converted to F-4N configuration in September 1974 and the Phantom II eventually ended its career with VMFA-323 in December 1979.



6

F-4B-15-MC BuNo 151003/NL107 of VF-151, USS *Coral Sea* (CVA-43), August 1965

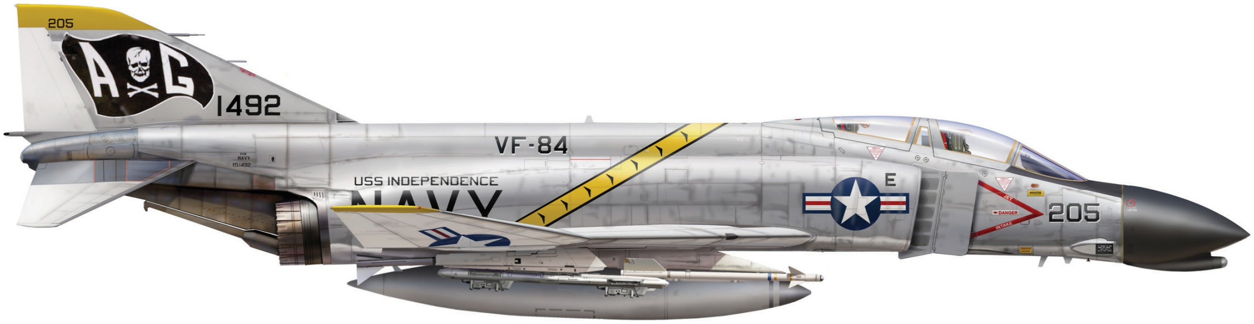
VF-151 made seven combat deployments between December 1964 and March 1973, and it continued to fly Phantom IIs until mid-1986, serving with CVW-5 at NAS Atsugi, in Japan. This aircraft initially entered service with the USAF as an F-110A in 1963, the fighter being one of a number loaned to the air force by the US Navy to train F-4C crews. It was converted into an F-4N in 1974 and withdrawn from use four years later.



7

F-4B-16-MC BuNo 151414/NG 204 of VF-92, USS *Ranger* (CVA-61), June 1965

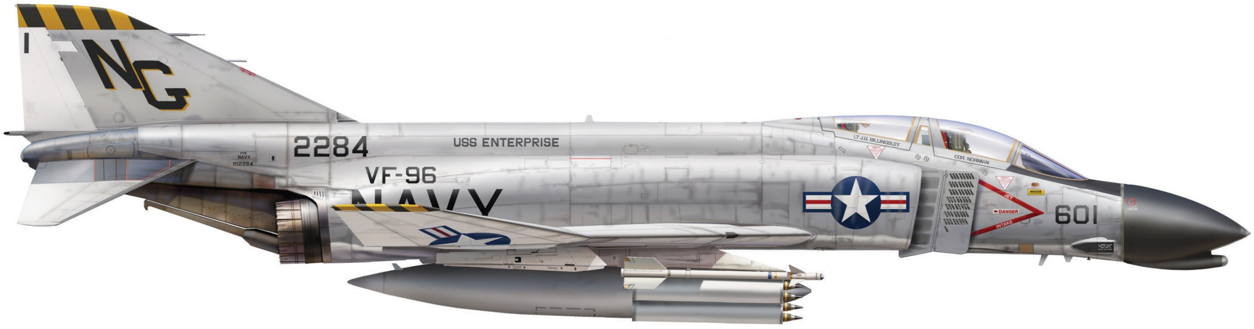
Ranger's initial combat deployment with TF 77 was made with CVW-9 embarked, the latter making its first cruise since having its designation changed from a carrier air group to a carrier air wing. Following three weeks of training in the Hawaii Operating Area, CVA-61 headed for TF 77. In action from August 1964, CVW-9's two F-4 units experienced the first aerial encounter with communist MiGs – both North Vietnamese and Chinese. VF-92 would make eight Westpac combat deployments in all, operating from four different carriers. NG 204 is depicted here in the squadron's earliest F-4 colour scheme. It was lost to 0.50-cal machine gun fire on 22 January 1968 during the relief of the US Marine Corps base at Khe Sanh whilst being flown by the CO of VMFA-323, Lt Col Harry Hagaman. He and his RIO, Capt Dennis Brandon, were quickly rescued by a US Marine Corps helicopter.



8

F-4B-19-MC BuNo 151492/AG 205 of VF-84, USS *Independence* (CVA-62), October 1965

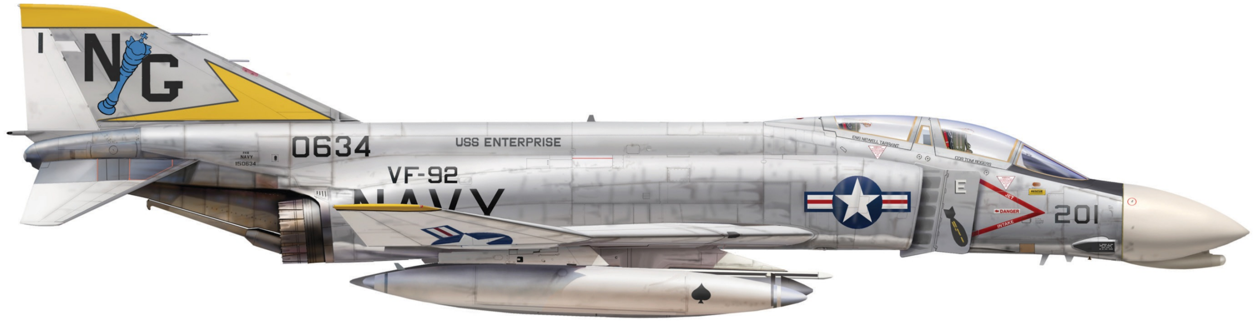
VF-84 was one of the Atlantic Fleet squadrons deployed to the Gulf of Tonkin with CVW-7 for a single war cruise, flying from CVA-62. Seventeen aircraft were lost, including three from VF-84, although this F-4B survived until 16 December 1967 when it was hit in its flight control system during a flak suppression mission with VF-21 near Haiphong. Its crew, Lt Cdr Duke Hernandez and Lt(jg) S L Vanhorn, were rescued after Hernandez flew the aircraft out to sea with only the rudder and throttles as means of flight control.



9

F-4B-23-MC BuNo 152284/NG 601 of VF-96, USS *Enterprise* (CVAN-65), June 1966

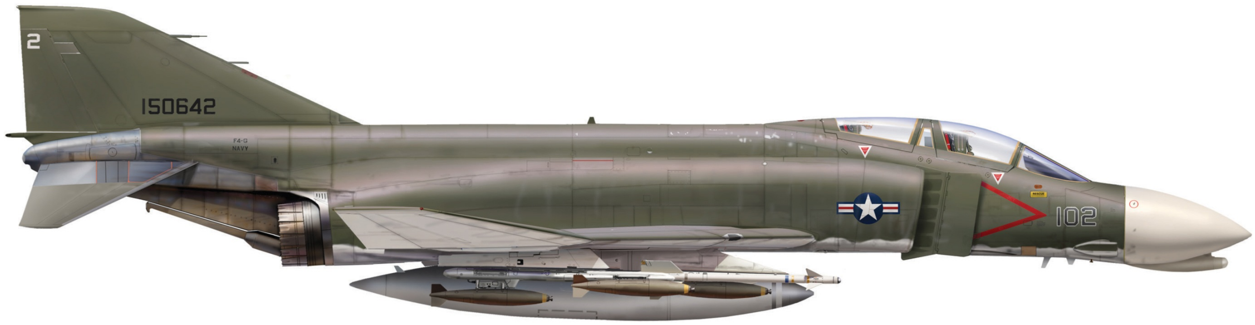
An impressive bomb scoreboard on the variable intake ramp of NG 601 epitomises the task of F-4 units at the height of *Rolling Thunder* operations. The squadron's original 'tiger stripes' markings, first applied when the unit was briefly designated VF-142 in 1962, gave way to simpler black decor in 1967 and then to the more familiar 'black falcon' tail design in 1968. For its first cruise with CVW-9 in 1963, VF-96 was allotted 100-series modex numbers at a time when the US Navy was trying to match squadron numbers (VF-92 and VF-96 in this case) with carrier air wings (CVW-9). Its 600-series sidenumbers appeared for its first combat cruise in 1964, and they remained in use from August 1964 through to July 1968, when the unit converted to the F-4J with 100-series sidenumbers that remained in use until 1973. Eventually upgraded to F-4N specification, BuNo 152284 was lost in a mid-air collision with F-4N BuNo 151413 on 27 July 1979 over the bombing range at Marine Corps Air Ground Combat Center Twentynine Palms, in California. Both jets were serving with US Marine Corps Reserve-manned VMFA-321 at the time.



10

F-4B-14-MC BuNo 150634/NG 201 of VF-92, USS *Enterprise* (CVAN-65), July 1966

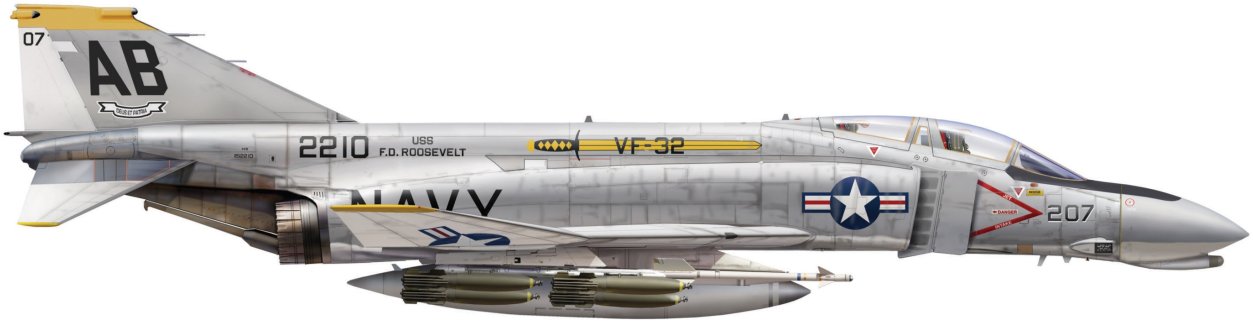
Cdr Tom Rogers' assigned F-4B bears the evidence of 134 combat sorties (denoted in a single bomb marking on the variable intake ramp), dropping 87 tons of ordnance during its October 1965-June 1966 cruise. Originally loaned to the USAF as 62-12174 for training purposes, this aircraft was a MiG killer for Lt Cdr Dan Macintyre and Lt(jg) Allen Johnson on 6 October 1965 when it was assigned to VF-151 – the jet also flew in combat with VF-161, VF-41 and VF-21 in 1965-66. Surviving until June 1983, BuNo 150634 was removed from storage at Davis-Monthan AFB's Military Aircraft Storage and Disposition Center (MASDC) and used as a range target at Nellis AFB.



11

F-4G (F-4B-14-MC) BuNo 150642/NH 102 of VF-213, USS *Kitty Hawk* (CVA-63), April 1966

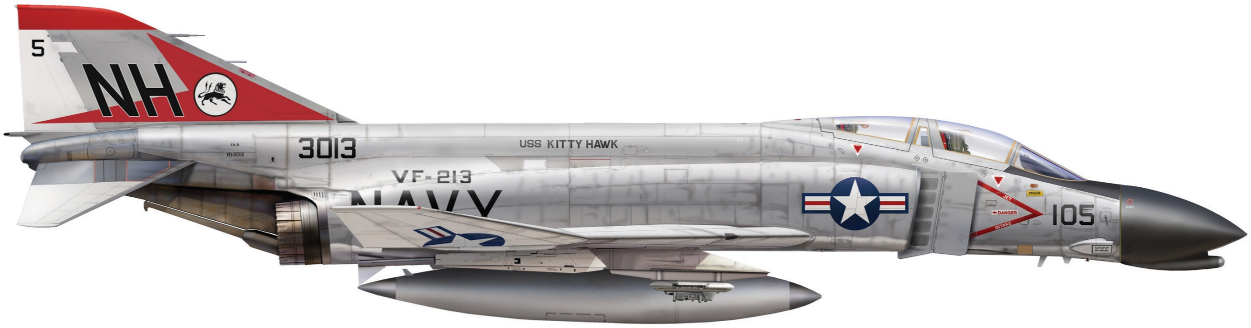
The USAF's toned-down camouflage policy was tested on one half of CVW-11's squadrons in 1965, including the data-link-equipped F-4Gs of VF-213. This aircraft began its service life with VF-96 in July 1963. It was restored to F-4B configuration in 1966 and flew with VF-121, VF-171 and, as an F-4N, VF-51, VF-201 and VF-202, before briefly returning to VF-171 prior to its retirement on 22 February 1984.



12

F-4B-20-MC BuNo 152210/AB 207 of VF-32, USS ***Franklin D Roosevelt*** **(CVA-42), December 1966**

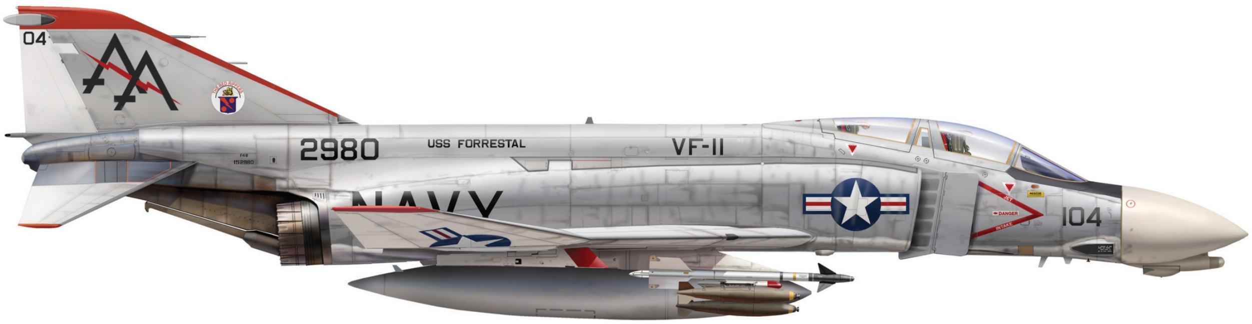
The US Navy’s first supersonic squadron after introducing the F8U-1 Crusader to fleet service in March 1957, VF-32 flew photoreconnaissance escort missions over Cuba during the Missile Crisis of October 1962. The ‘Swordsmen’ converted to the F-4B in 1965 and joined CVW-1 as an Atlantic Fleet unit, but wartime requirements diverted the carrier air wing to Southeast Asia for a combat cruise from June 1966 to February 1967. AB 207 has the short-lived AN/APR-24 RHAW antennas on its fin cap. Several squadrons had around five aircraft fitted with this early attempt at defeating the SAM threat, and it was replaced by several more advanced variations throughout the F-4B’s career. Having also served with VF-41, BuNo 152210 was upgraded to F-4N specification and eventually retired to MASDC in October 1977. It was salvaged at nearby Bob’s Air Park in June 1990.



13

F-4B-26-MC BuNo 153013/NH 105 of VF-213, USS *Kitty Hawk* (CVA-63), April 1967

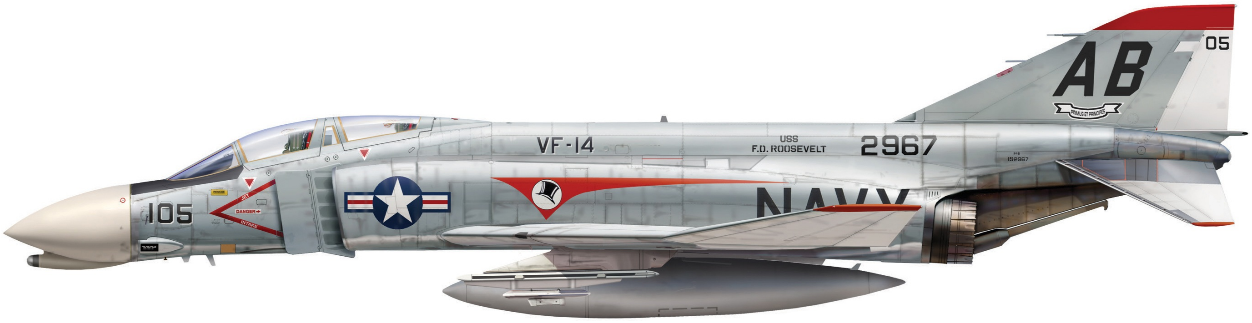
VF-213 made its second Westpac cruise with an F-4B complement from November 1966 to June 1967. NH 105 continued in ‘Black Lions’ service after the 1967-68 cruise, and it was still assigned to the unit when it was lost at NAS Fallon, Nevada, while making a simulated shipboard recovery on 21 October 1968. The squadron’s markings changed very little when it transitioned to the F-4J in 1970.



14

F-4B-25-MC BuNo 152980/AA 104 of VF-11, USS *Forrestal* (CVA-59), July 1967

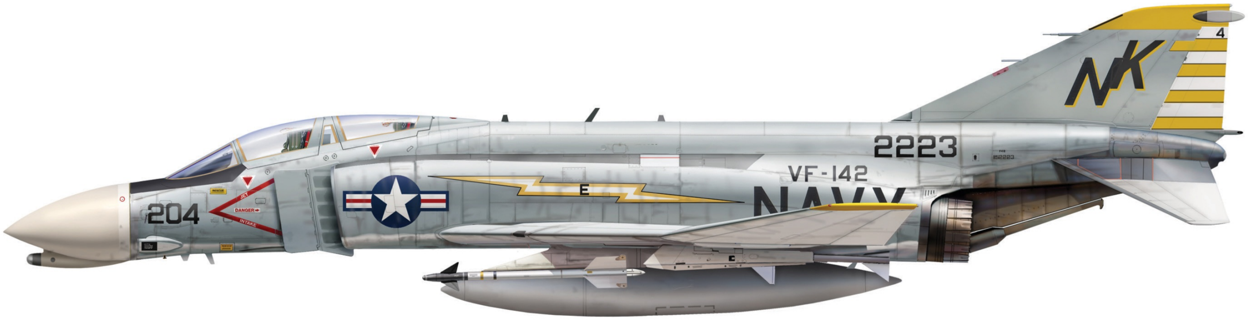
Embarked in *Forrestal* with CVW-17 from 6 June 1967, VF-11’s only ‘on-line’ combat period was terminated after just five days by a massive conflagration aboard the carrier. The ‘Red Rippers’ resumed their usual Atlantic Fleet posture thereafter. This F-4B was still with VF-11 on 2 May 1971 when it crashed while attempting to land on Forrestal during a Sixth Fleet deployment. It is fitted with AN/APR-30 RHAW antennas under its radome and air intake ducts, although it lacks a forward-looking AN/APR-30 antenna at the front of its fin cap. AN/APR-30 was installed on many F-4Bs from 1966 onwards. The Mk 82 bombs, seen here, were often fitted with ‘daisy cutter’ fuse extenders, particularly for flak suppression missions.



15

F-4B BuNo 152967/AB 105 of VF-14, USS *Franklin D Roosevelt* (CVA-42), May 1967

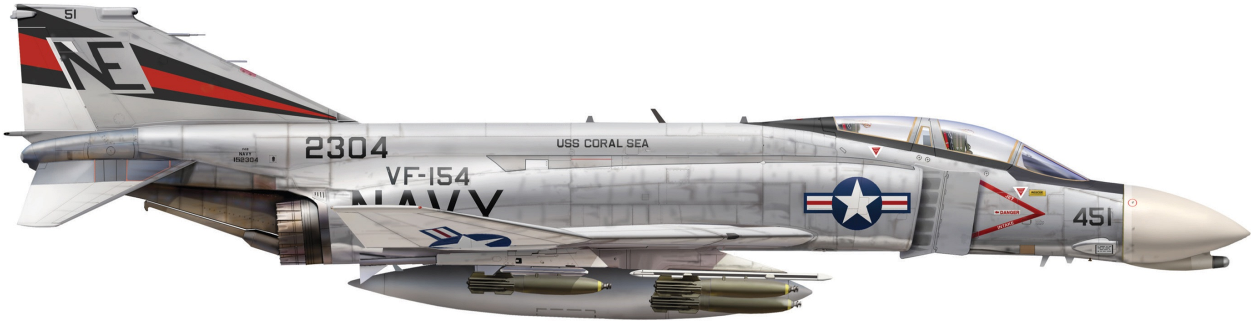
Paired with VF-32 in CVW-1, VF-14 operated from CVA-42 when it was selected in 1966 as one of the ten aircraft carriers to rotate to the Seventh Fleet. Led by Cdr Dick Adams, the squadron completed 95 days of intensive combat operations. This aircraft joined the ‘Bee-line’ F-4N conversion programme in 1975, completing its fleet service with training squadron VF-101 at NAS Key West, in Florida, in August 1977.



16

F-4B-21-MC BuNo 152223/NK 204 of VF-142, USS *Constellation* (CVA-64), July 1967

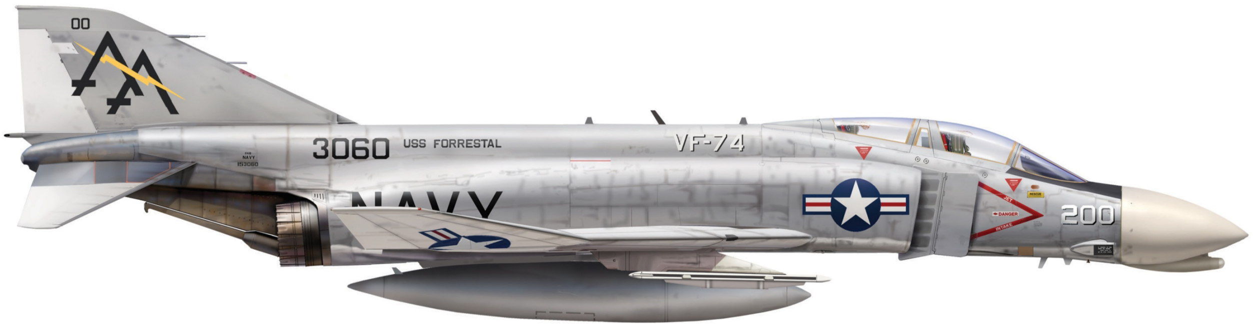
VF-142's seven CVW-14 Vietnam War cruises included four onboard *Constellation* that yielded three MiG kills by October 1967. Another ECM antenna variation appears on NK 204, with an AN/APR-30 trailing-edge antenna and others beneath the intakes and in the pod beneath the radome. It is loaded for MiGCAP duties with two AIM-7Es in the rear wells and AIM-9Ds on the inner pylons. This aircraft later became an F-4N, serving until it was struck off charge at NAF China Lake, California, in August 1982. The jet was salvaged the following year.



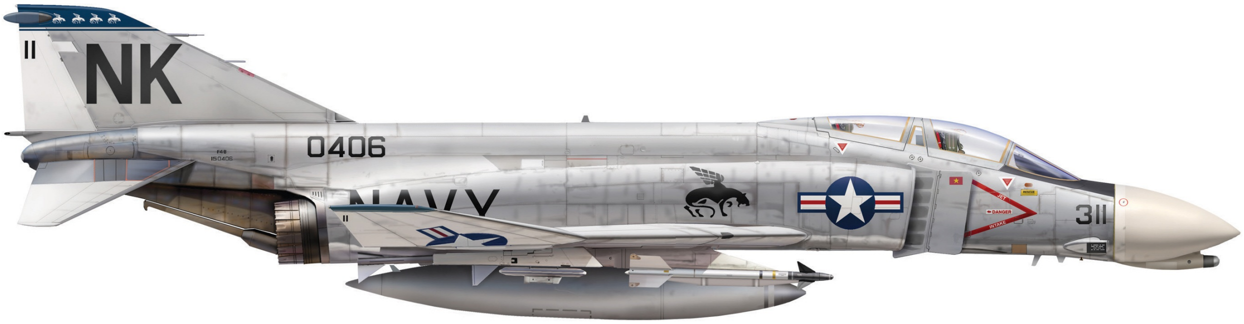
17

F-4B-23-MC BuNo 152304/NE 451 of VF-154, USS *Coral Sea* (CVA-43), January 1967

VF-154 entered the Vietnam conflict in December 1964 flying F-8D Crusaders for an 11-month cruise on CVA-43. By July 1966 it had converted to the F-4B and re-embarked with CVW-2 on the same carrier, followed by five more cruises onboard *Ranger*. Shortly after returning to NAS Miramar from its Westpac with VF-154 in late February 1967, BuNo 152304 was transferred to VF-151 and sent back to TF 77 (again embarked in CVA-43, which was now home to CVW-15) just five months later. On 19 November 1967 the fighter was bounced and shot down, along with F-4B BuNo 150997, in a MiG-17 ambush near Haiphong. BuNo 152304's pilot, Lt(jg) James Teague, was killed and RIO Lt(jg) Theodore Stier captured.



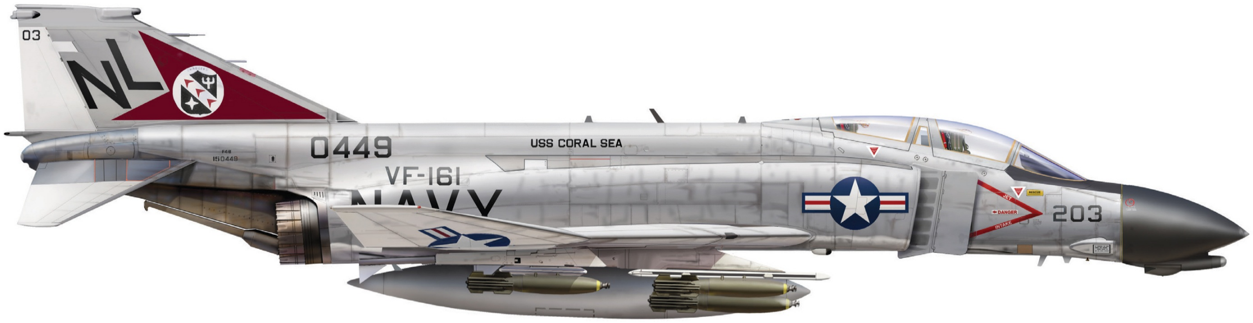
18
F-4B-28-MC BuNo 153060/AA 200 of VF-74, USS *Forrestal* (CVA-59), July 1967
VF-74's first Westpac cruise was curtailed by a major fire in which this Phantom II was one of seven F-4Bs (and 14 A-4 Skyhawks and RA-5C Vigilantes) destroyed in the conflagration. Its brief existence began with a first flight on 1 September 1966 and delivery to the US Navy on 22 November for a carrier deployment that commenced on 6 June 1967. Marked up as VF-74's 'CAG' jet, BuNo 153060 had accrued just 321 hours of operational use prior to its burned-out remains being pushed overboard from the crippled carrier.



19

F-4B-12-MC BuNo 150406/NK 311 of VF-143, USS *Constellation* (CVA-64), August 1967

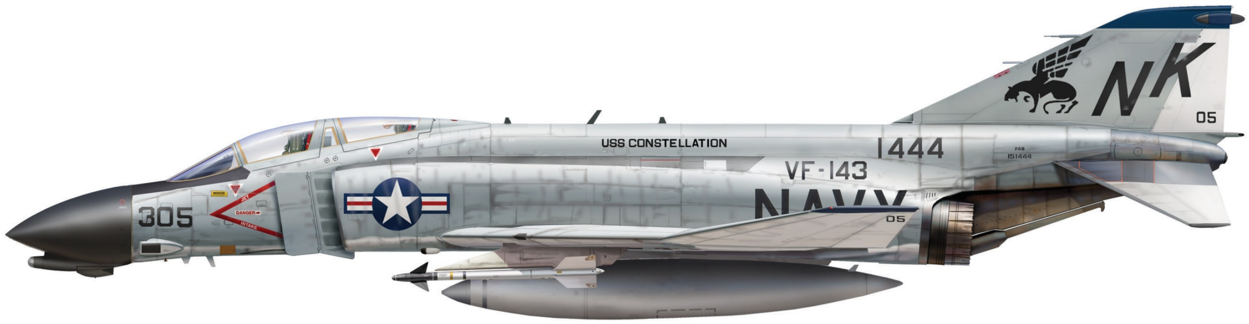
One of the original batch of F4H-1s delivered to the US Navy, this aircraft bears the squadron’s early markings that consisted of a black griffin (dubbed a ‘pukin’ dog’) motif on the fuselage flank and four small white ‘dogs’ in a navy blue band on the tip of the fin. Essentially the same scheme was worn by VF-143’s jets for its 1964-65 cruise, again onboard *Constellation*. The ‘dog’ later moved to the tail, before returning to the fuselage when the squadron converted to F-4Js. This aircraft later served with VF-51, and it was lost whilst still with the unit in a deck accident onboard *Coral Sea* during Operation *End Sweep* (the de-mining of North Vietnamese waters) as part of TF 77 on 19 May 1973.



20

F-4B-13-MC BuNo 150449/NL 203 of VF-161, USS *Coral Sea* (CVA-43), December 1967

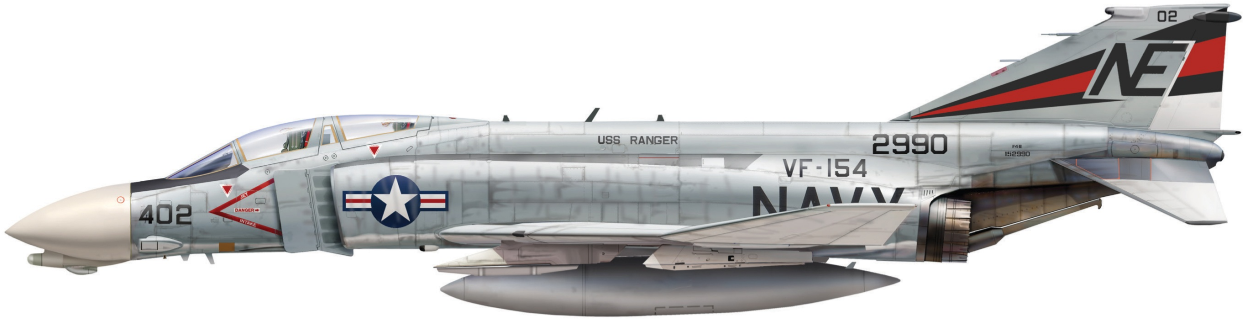
This F-4B has all the ECM antennas for the AN/APR-30 system as well as a load of Mk 82 Mod 2 TP bombs with Snakeye retarding fins. On 29 December 1967 it was struck by ground fire during a weather reconnaissance mission near Cam Pha. A fire filled the cockpit with smoke and Lt J F Dowd and Lt(jg) G K Flint had to eject – they were quickly rescued by a US Navy helicopter.



21

F-4B-17-MC BuNo 151444/NK 305 of VF-143, USS *Constellation* (CVA-64), November 1968

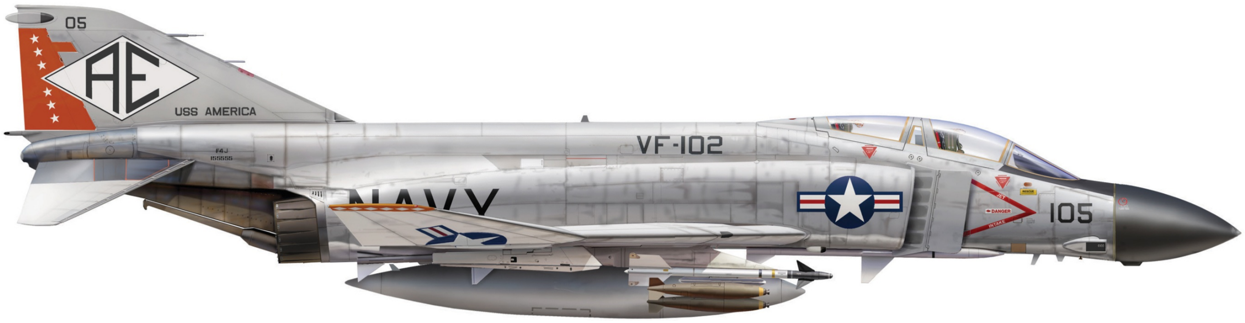
Displaying the second version of the squadron’s markings, NK 305 has a partial AN/APR-30 ECM fit. It was flown (in the earlier scheme) by Lt(jg)s Bob Hickey and Jerry Morris as ‘Taproom 307’ for their 26 October 1967 MiG kill mission in which a MiG-21 was shot down with an AIM-7 missile. It became an F-4N-15-MC in June 1974, flew with VF-21 in 1981 and was withdrawn from use and sent to MASDC in July 1982. The fighter was eventually scrapped in November 2004.



22

F-4B-25-MC BuNo 152990/NE 402 of VF-154, USS *Ranger* (CVA-61), 21 October 1967

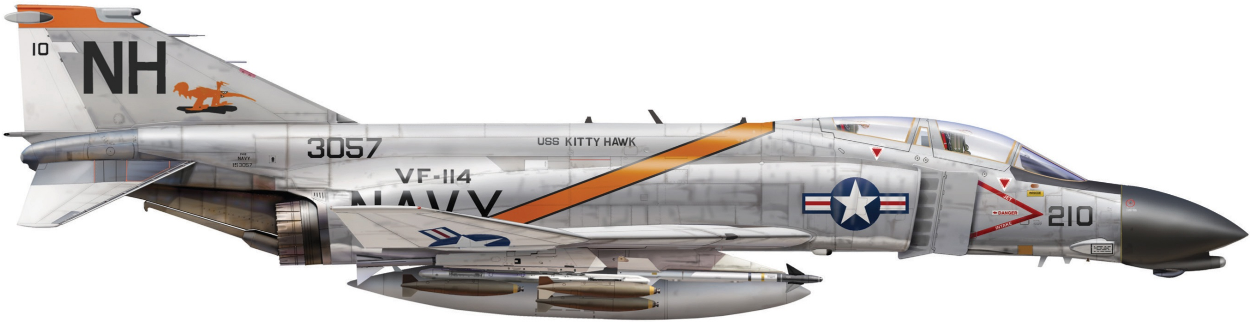
This aircraft has the full AN/APR-30 ECM fit and the slotted stabilator seen on some F-4Bs. Radomes came in either black or off-white finish, and they were fitted randomly on both F-4Bs and F-4Js. The 'Black Knights'' second F-4B cruise was followed by four more with the F-4J. Converted to F-4N status in March 1977, BuNo 152990 completed its fleet service with VF-21, including a period as the unit's NK 200 'CAG bird' onboard *Coral Sea* during the vessel's 1981-82 Westpac – the jet also participated in CVW-14's final Phantom II cruise in 1983, although by then it was NK 204. BuNo 152990 was retired to MASDC in November 1983.



23

F-4J-33-MC BuNo 155555/AE 105 of VF-102, USS *America* (CVA-66), July 1968

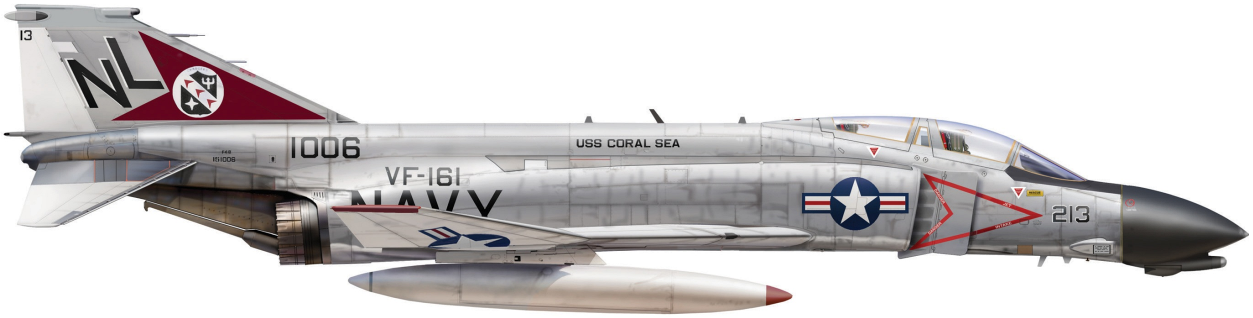
As the second Atlantic Fleet squadron to be equipped with the F-4B, VF-102 brought plenty of Phantom II experience to its only Westpac deployment from April to December 1968 following conversion to the F-4J. On this first combat deployment for the J-model jet, the unit sustained no losses during 112 days on the line with TF 77. Post-war, this aircraft passed through the F-4S conversion line and ended its service life with VMFA-112 in 1987.



24

F-4B-28-MC BuNo 153057/NH 210 of VF-114, USS *Kitty Hawk* (CVA-63), March 1968

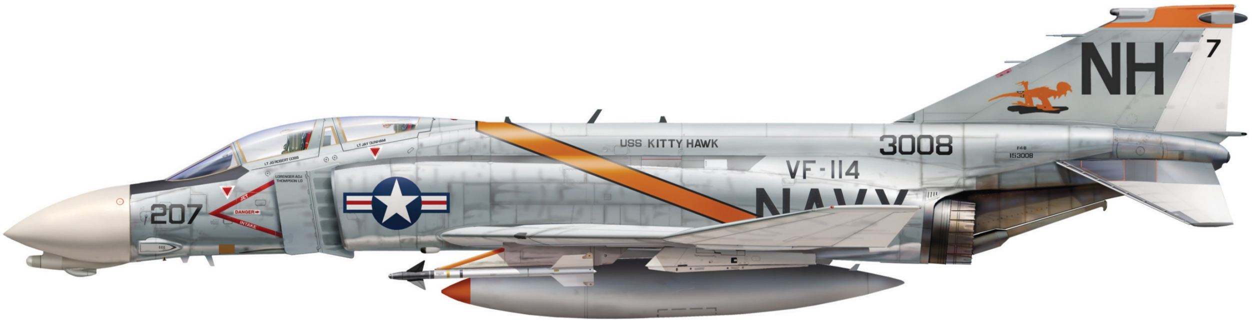
This aircraft, from the final F-4B production block, displays a later version of VF-114 ‘Aardvarks’’ decor. The central motif was derived from the ‘B.C.’ comic strip created by Johnny Hart and requested for the squadron’s use by its Executive Officer, Cdr Roscoe Trout. To some observers the Phantom II’s drooping nose, drooping tail and raised canopies conjured up images of the bright orange scaly anteater that adorned the tails of VF-114’s jets. After a tour with VMFA-115 this F-4B was upgraded to F-4N standard and eventually retired in 1982.



25

F-4B-15-MC BuNo 151006/NL 213 of VF-161, USS *Coral Sea* (CVA-43), November 1968

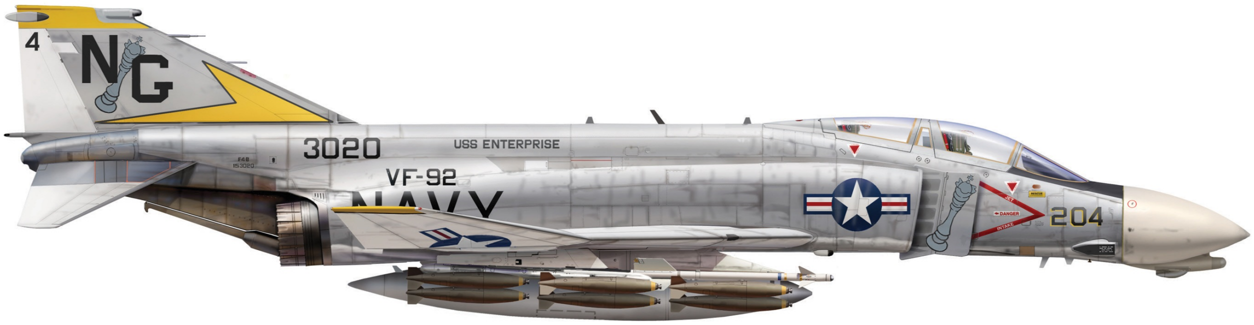
This squadron and its sister unit, VF-151, were unique in making all seven of their wartime deployments with the F-4B. This particular aircraft was among the Phantom IIs loaned to the USAF in June 1963 (as 62-12188), before providing many years of service to VF-161 and retiring in October 1977 after conversion to an F-4N. The 370-gallon Sargent Fletcher outboard fuel tanks seen here were seldom uploaded for carrier operations but often carried for ferry flights or shore-based sorties. However, two squadrons briefly used Mk 4 gun pods in place of a centreline tank, necessitating the employment of wing tanks.



26

F-4B-26-MC BuNo 153008/NH 207 of VF-114, USS *Kitty Hawk* (CVA-63), January 1969

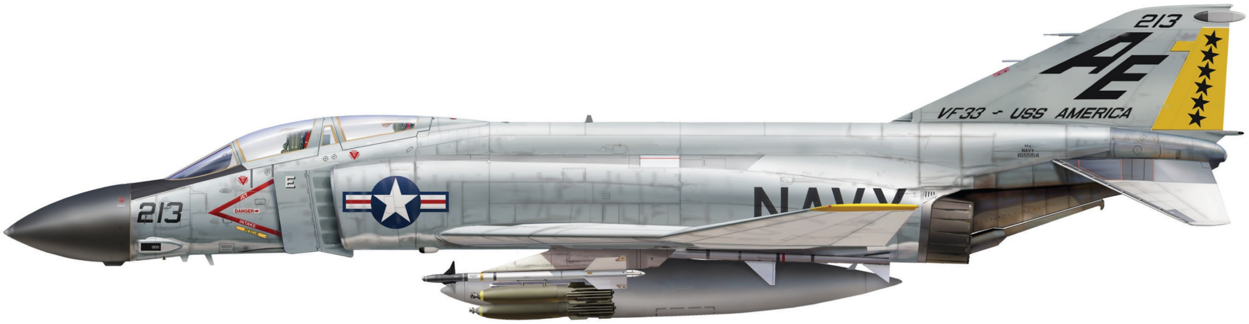
BuNo 153008 has a complete AN/APR-30 fit (replacing the AN/APR-24 and a black radome in this aircraft) and a slotted stabilator, NH 207 being assigned to Lt(jg)s Robert Cobb and Jay Dunham during VF-114's 1968-69 TF 77 deployment. First flown in April 1966, this aircraft later undertook a combat deployment with VF-151 in 1971, a 1980 Westpac deployment with VMFA-323 and another with VF-154 in 1983 onboard Coral Sea. The jet, which had been updated to F-4N-30-MC specification in 1975, was retired to MASDC as FP008 in 1983 and subsequently transported to RAF Alconbury, in Cambridgeshire, in VF-154 markings (NK 111) as a battle damage repair airframe in 1986. It was scrapped ten years later.



27

F-4B-26-MC BuNo 153020/NG 204 of VF-92, USS *Enterprise* (CVAN-65), June 1968

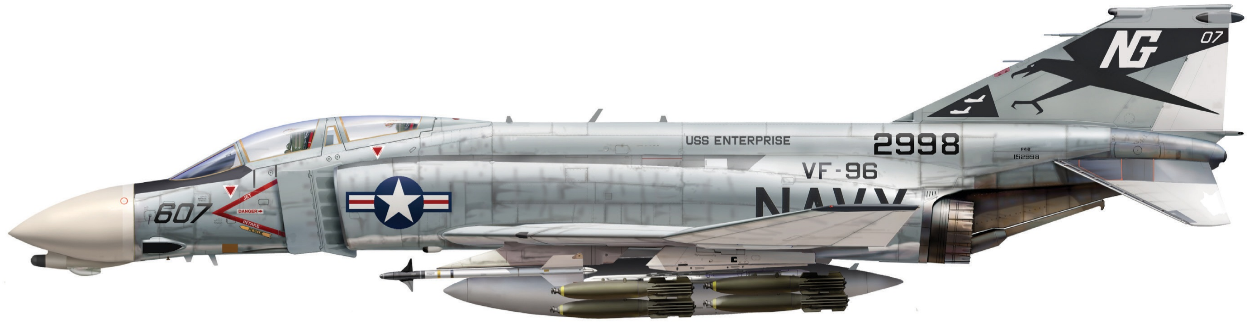
Decorated with a later version of the 'Silver Kings'' scheme, this aircraft flew *Rolling Thunder* missions and later returned to battle with VF-161, becoming a double MiG-killer with Lt Cdr 'Mugs' McKeown and Lt John Ensch at the controls on 23 May 1972. It was lost with that unit on 25 August 1972 after a SAM hit during a CAP mission, Lt Cdr M W Doyle and Lt Ensch being taken prisoner. BuNo 153020's varied service life also included time with VF-121, VF-114, VF-213 and two US Marine Corps units, VMFA-314 and VMFA-122. In this view it carries Mk 82 bombs for a radar-directed (TPQ) 1968 bombing mission, with Sidewinders for self-defence.



28

F-4J-33-MC BuNo 155554/AE 213 of VF-33, USS *America* (CVA-66), June 1968

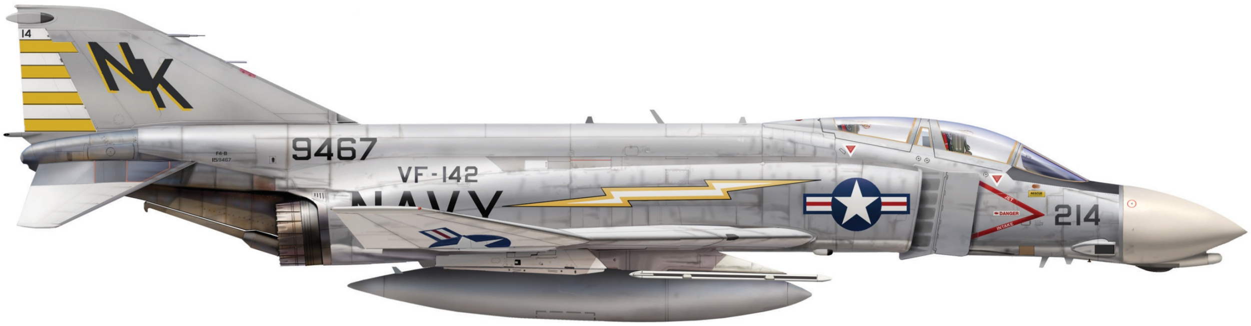
This squadron (with VF-102) introduced the F-4J to combat during CVW-6's only wartime deployment embarked in *America* from April to December 1968. The unit scored one MiG kill and lost three aircraft in 4000 combat hours, including this jet, which was hit by AAA during a 4 June 1968 attack sortie on a road intersection near Don Cay. The 'Tarsiers' flew F-4Bs from November 1964 and operated F-4Js until January 1981 – longer than any other US Navy squadron. Early F-4Js had 'clean' radomes, but the small antenna fairing for the AN/ALQ-51A deceptive electronic counter-measures (DECM) system had been added by mid-1968.



29

F-4B-26-MC BuNo 152998/NG 607 of VF-96, USS *Enterprise* (CVAN-65), June 1968

VF-96's third combat cruise onboard *Enterprise*, from January to July 1968, yielded a MiG kill and one operational loss during 100 days on the line. The 'MiG' symbols included in the tail markings (the later originated by RIO Lt(jg) John E Wohlfiel) also mark the squadron's April 1965 shoot-down of a Chinese MiG-17. Operation *Linebacker* in 1972 would bring eight more kills, making VF-96 the most successful MiGkilling unit in the US Navy. This Phantom II ended its service life with VMFA-115 when its crew was forced to eject after an in-flight fire on 19 October 1974.



30
F-4B-11-MC BuNo 149467/NK 214 of VF-142, USS *Constellation* (CVA-64), November 1968
Many early-production F-4Bs remained in squadron service up to the end of Operation *Rolling Thunder* and beyond. This example, depicted during the last of VF-142's four F-4B cruises, has the AN/APR-25 ECM system with a revised fairing under the radome for an AN/ALQ-51/100 antenna. Transferred to VMFA-314, BuNo 149467 was lost on 8 February 1970 while making a napalm attack near Duc Pho. One of the underwing napalm tank's igniters was probably hit by AAA, causing a fire in the aircraft's wing (see the cover art for *Osprey Combat Aircraft 94 – US Marine Corps Phantom II Units of the Vietnam War*), which in turn led to both crewmen ejecting and being rescued.

Author

Peter E Davies has published 26 books concentrating on modern combat aircraft and the Vietnam War. He has written 16 previous Osprey titles and co-authored two others. Four of these have concentrated on the US Navy's use of the F-4 Phantom II, and another of his books, running to 250 pages on this topic for American publisher Schiffer, is still selling 16 years after publication. All his books on this subject have contained extensive input from interviews with more than 100 former US Navy Phantom II aircrew, maintainers and mission planners.

Illustrator

Jim Laurier is a native of New England, growing up in New Hampshire and Massachusetts. He has been drawing since he could hold a pencil and throughout his life he has worked in many mediums creating artwork on a variety of subjects. He has worked on the Osprey Aviation list since 2000, and in that time he has produced some of the finest artwork seen in these volumes. He has specialised in aircraft of the Vietnam War period.

Acknowledgements

The author is grateful to the following individuals for their assistance – Capt George K Baldry US Navy (ret), Lt David Batson US Navy (ret), Capt Roy Cash US Navy (ret), Cdr Charles D'Ambrosia US Navy (ret), Capt Orville G Elliott US Navy (ret), Cdr Grover G Erickson US Navy (ret), Cdr Guy H Freeborn US Navy (ret), Cdr William E Greer III US Navy (ret), Capt William B Haff US Navy (ret), John J Harty (McDonnell Douglas), Capt Jerry B Houston US Navy (ret), Lt W Fritz Klumpp US Navy (ret), Capt William D Knutson US Navy (ret), Capt Eugene P Lund US Navy (ret), Mary Jane at VetFriends, Lt Cdr William J Mayhew US Navy (ret), Cdr Stephen A Rudloff US Navy (ret), Capt Frederick G Staudenmayer US Navy (ret) and RADM John R Wilson Jr US Navy (ret).

Front Cover

On the night of 26 October 1965 F-4B Phantom II BuNo 151505, call-sign 'Victory 208', from VF-84 'Jolly Rogers',embarked in USS *Independence* (CVA-62), was involved in a three-aircraft attack on targets of opportunity located on Bach Long Vi Island, 70 miles off the North Vietnamese coast. Lt Grover Erickson (pilot) and Lt(jg) John Perry (RIO) arrived on target over a torpedo boat anchorage at 0100 hrs and dropped six Mk 24A parachute flares from a height of 6000 ft in order to illuminate the target. They followed up with a firing pass in which four LAU-3A rocket pods of 2.75-in unguided rockets were launched from 2500 ft in a 450-kt 20-degree dive.

As Lt Erickson turned hard right to clear the target he felt two AAA hits on his aircraft, one in the tail area and another in the wing root. He quickly lost rudder control, the undercarriage extended and then retracted and fire warning lights appeared. As smoke began to enter the cockpit and a complete electrical failure occurred the two men ejected and were soon recovered by a UH-2A rescue helicopter (*Cover artwork by Gareth Hector*)

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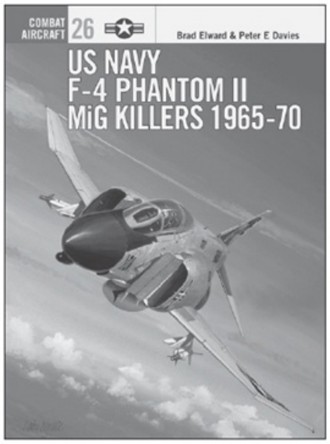
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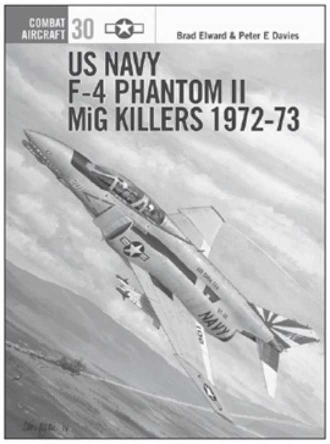
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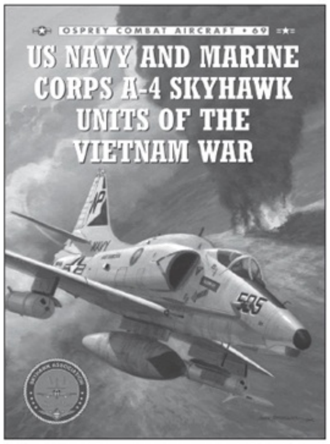
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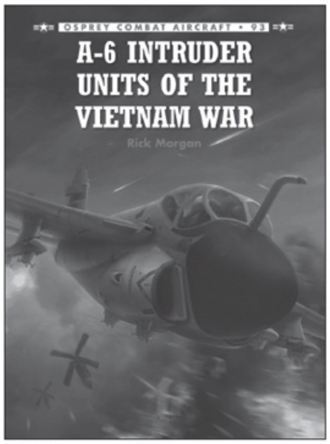
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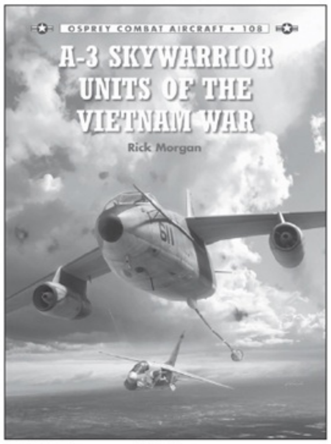
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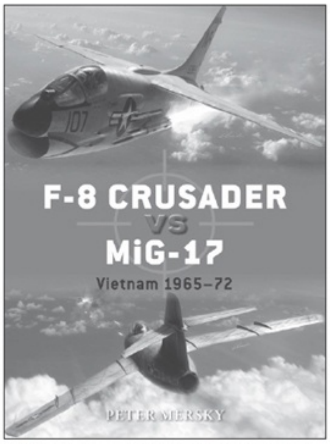
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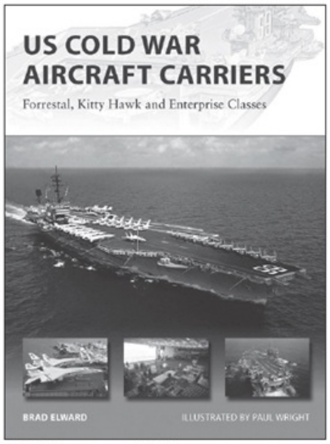
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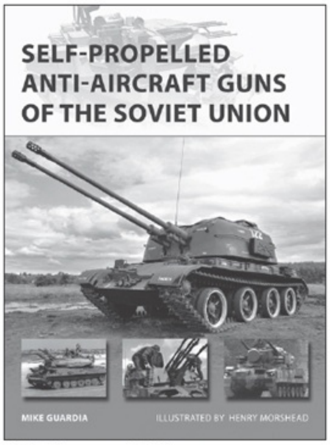
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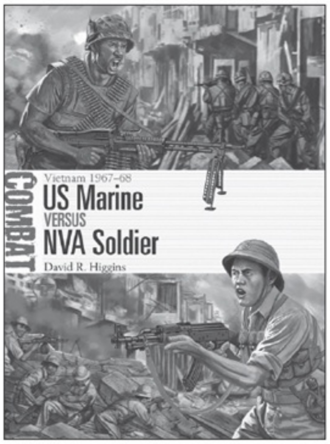
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